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THE MEGIDDO WATER SYSTEM

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THE MEGIDDO WATER SYSTEM

By
ROBERT S. LAMON

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PREFACE

The author wishes to acknowledge the assistance of the various members of the Megiddo Expedition, all of whom have made many valuable suggestions. He is especially indebted to Mr. Geoffrey M. Shipton and Dr. Herbert G. May, who jointly contributed practically the whole of the section on pottery and other objects, and to Mr. Olaf E. Lind, who by all manner of ingenious methods, under the most trying conditions, procured the excellent photographs.

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INTRODUCTION

The history of Megiddo, as indicated in the written records and through excavation, has been one of almost continual strife. That it was a well fortified stronghold has been amply demonstrated by the discovery of thick city walls encircling the flat top of the high, steep-sided mound. Capture by storm was therefore practically impossible; but, regardless of how strong the fortifications were, a lack of water within the city would have rendered it powerless to withstand a siege, and therefore a supply of water inside the city wall was very nearly as important as the wall itself.

The discovery of the town well and its ramifications, here described, indicates that the necessity for a good internal supply of water was fully realized at least as early as the beginning of the 12th century B.C. This well is located at the foot of the mound definitely outside the city wall. During the earlier history of Megiddo it was entirely unprotected, and access to it was attained only by a steep climb down the exposed side of the mound.

Although there must certainly have been some supply of water inside the city during the times previous to the 12th century, the fact that this unprotected well *was* used and *was* maintained practically continuously during earlier times is fair indication that it was at least one of the chief sources of water. Probably the supposed pre-12th century internal supply was either too inconveniently located or not adequate for ordinary use and was maintained only as an emergency supply for use if the main well fell into the hands of an enemy. At present there is little indication as to where this early internal water supply was located or as to what form it took. No cisterns have been found; and at a site such as Megiddo, where rock outcrop is entirely lacking, it is highly improbable that cisterns were ever used because of the difficulties in making them waterproof in a mound of artificial accumulation. And, too, cisterns would provide only a limited supply of water, so that a siege of long duration would be certain to succeed.

Schumacher has demonstrated that the spring ʿAin el-Kubbi to the north of the tell (in B 17, Fig. 1) is an artificial source and suggests that this *ʿain* and ʿAin es-Sitt, about a mile south of the tell, in the town of Lejjun, have a common origin about halfway between the two.[1] Such a remote source seems rather improbable, but that need not concern us here. The significant thing is that a small portion of a covered water channel (*B* in Fig. 1) exposed and mapped by Schumacher[2] leads in the direction of the tell, as indicated in Figure 1. Unfortunately no date could be assigned to that channel. Until recently we had considered that it was merely a continuation of a Roman channel which leads south along the eastern foot of the mound (see Fig. 1) and that ʿAin el-Kubbi owed its location to a leak in this channel. But the discovery of a depression on the top of the tell (at *A* in Fig. 1) directly in line with the underground channel reported by Schumacher rather suggests that the latter belongs to an earlier period. Though the depression has not yet been fully investigated, there is every indication that it marks the top of a vertical shaft, and the supposition is that it is in some way connected with the water channel at ʿAin el-Kubbi. The actual source of the water probably lies under the mound terrace. A Solomonic courtyard overlies this depression; and therefore, if it does mark the top of a vertical shaft leading to a water system, it may well be connected with the

[1] G. Schumacher, *Tell el-Mutesellim* I (Leipzig, 1908) 161–62.

[2] *Op. cit.* Fig. 233 and Pl. I.

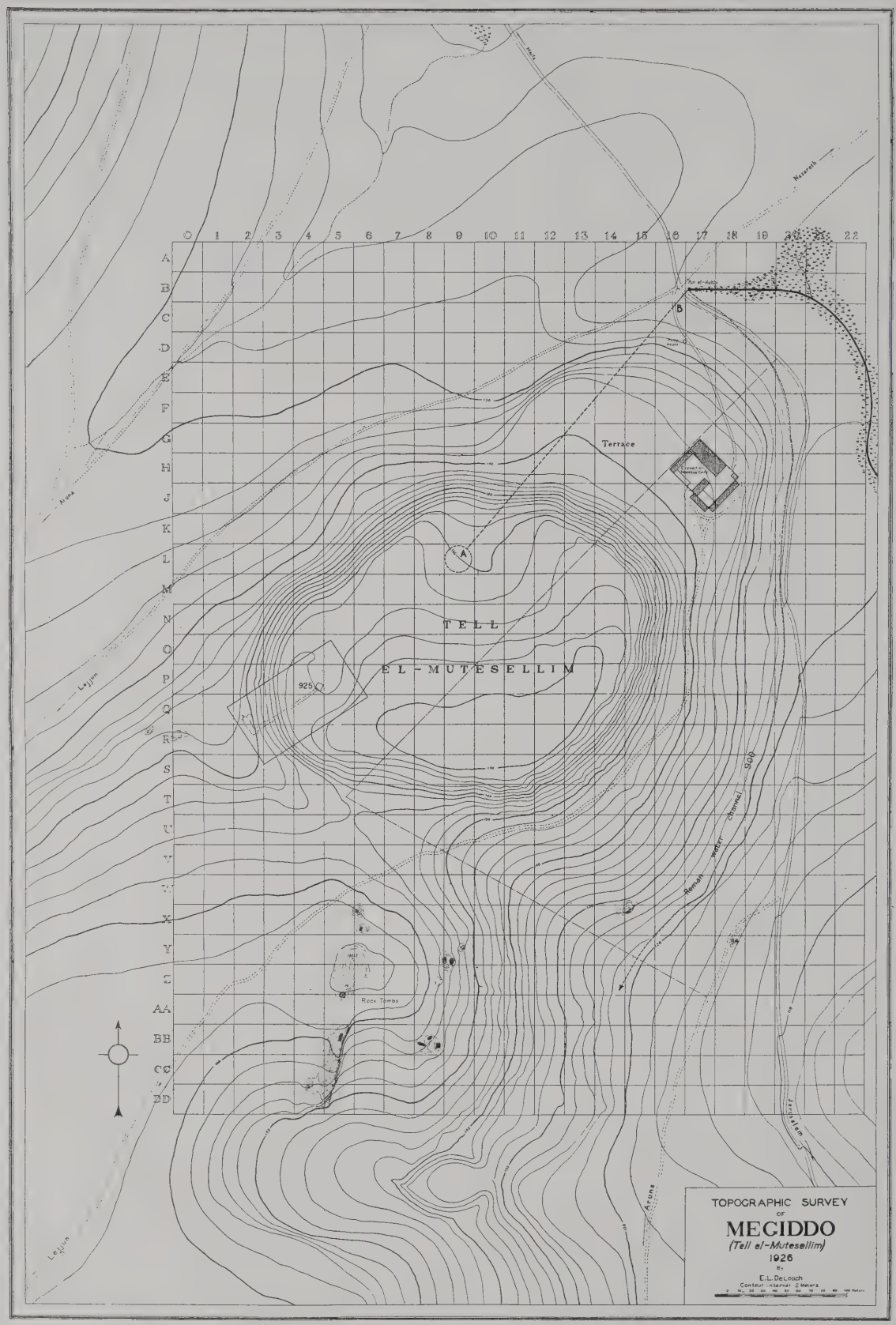

FIG. 1.—KEY PLAN OF MEGIDDO, SHOWING LOCATION OF THE WATER SYSTEM. SCALE, 1:5000
The rectangle at left delineates the area covered in Fig. 2.

supposed emergency supply used before the town well had been made accessible from within the city walls. However, it is useless to speculate on buried structures. Suffice it to say that there are indications of an early internal source of water. The purpose of this paper is to describe the later water system that is definitely known to exist.

While the Megiddo water system is probably the most pretentious yet discovered in Palestine, it is far from being unique; nor are the methods of construction without parallels. In certain of the previously known water systems, as in the case of the tunnel at Megiddo, the tunneling was begun at both ends and joined together with varying degrees of success. The best known examples of water tunnels are those connected with the Virgin's Fountain at Siloam[1] and one discovered at Gezer.[2] The general shape and contour of many unexcavated tells in Palestine suggest the existence of other similar underground structures.

The water system at Megiddo is particularly interesting in that its development can be reconstructed practically step by step; and this of course throws considerable light on the state of civilization existing during that time.

THE ORIGIN OF THE MAIN CAVE

The main cave (1008; see Figs. 2 and 3), which has rock-cut steps leading down to a well (1074), was in existence long before the tunnel (1000) was constructed. A wall (1007), built immediately after the completion of the tunnel, blocks the original entrance to the cave. The excavation of the area outside the blocking wall has not been completed, but presumably the rock-cut steps continue under the wall and lead up to the surface at the foot of the mound, as indicated in Figure 3, section E–F. Unlike the tunnel (1000) and its ramifications, which were obviously executed according to a definite and well-thought-out plan, the cave (1008) has the rough, irregular appearance of having evolved through some slow, semi-natural process.

It appears that in the very early history of Megiddo a surface spring issued forth at the foot of the hill somewhere in the region of Q 1 (extreme upper left-hand corner of Fig. 2). This spring gradually weakened until eventually it ceased to flow and became a pool or water hole; and subsequently, had it not been artificially deepened, the water hole would have dried up completely. The inhabitants of Megiddo pursued the water into the ground by deepening the hole and thus maintained their supply. The original spring, which had dwindled to a water hole, was then by necessity transformed into a well. As time went on, the water continued to sink, and the townsmen were forced to continue their pursuit by periodically deepening the well, generation after generation, until the well finally grew to its present size as represented by cave 1008.

It is probable that there has always been a considerable seasonal fluctuation of the ground water table[3] and that the deepening was brought about more or less unconsciously during the annual forced cleaning process. A great deal of silt would inevitably be washed into the well by the heavy winter rains, and as the level of the water sank during the dry summer months it would be necessary to remove the winter accumulation in order to provide a depth of water sufficient to submerge and fill large water jars. During this cleaning process a certain amount of soft, water-soaked limestone would be scraped from the bottom of the well along with the silt;

[1] H. Vincent, *Underground Jerusalem* (English translation; London, 1911) pp. 3–24; J. Garrow Duncan, *Digging up Biblical History* II (London, 1931) 201–15.

[2] R. A. Stewart Macalister, *The Excavation of Gezer* (London, 1912) I 256 ff. There is no definite evidence one way or another as to whether the Gezer tunnel was dug from both ends, but in the opinion of the present writer it seems highly probable that such was the case.

[3] The present fluctuation is somewhat over half a meter.

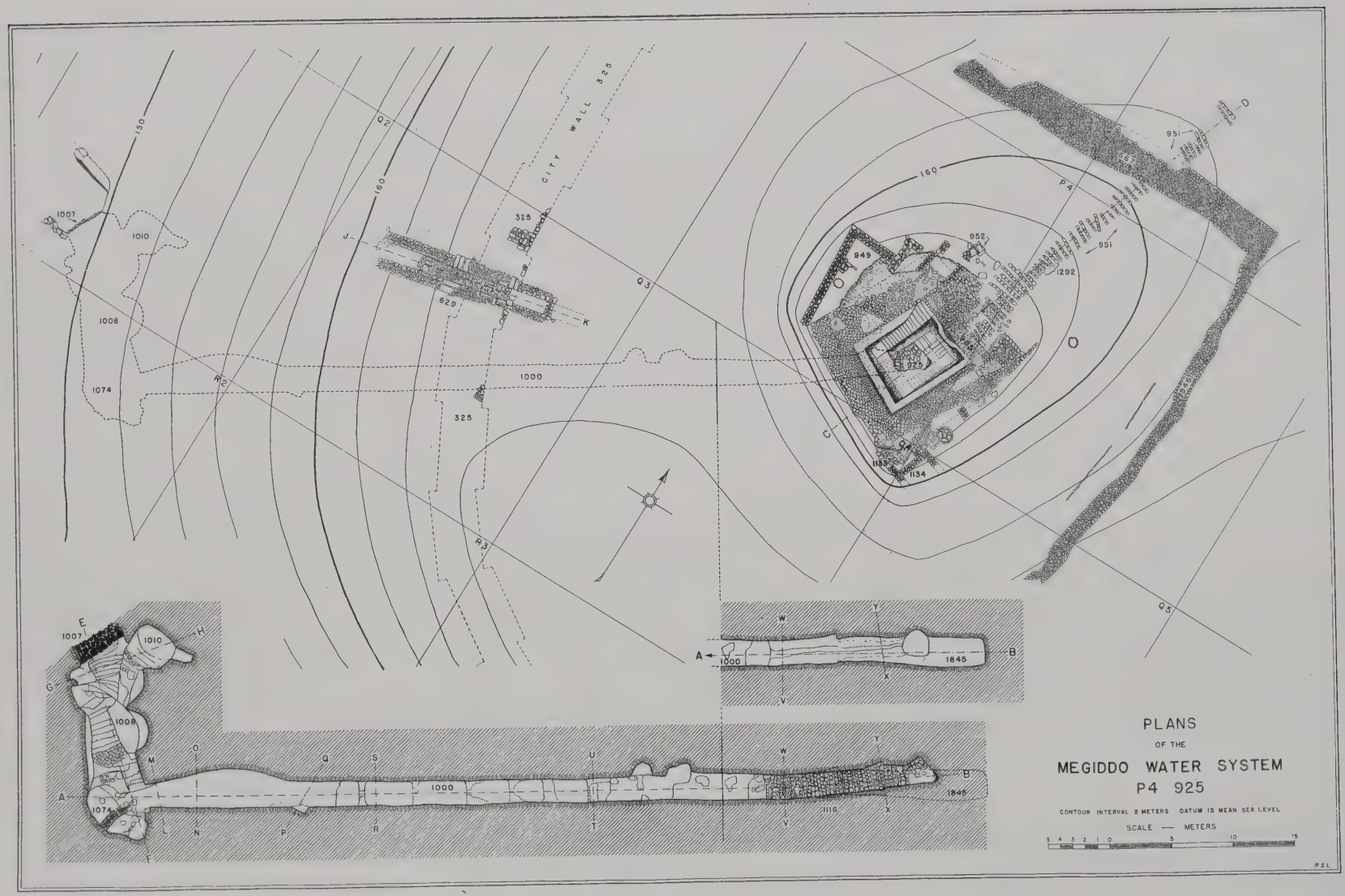

FIG. 2.—PLANS OF THE WATER SYSTEM. SCALE, 1:500

The bottom plan shows the underground part of the system as it would appear were the rock above it removed. The outline of this underground part is shown in broken line in the top plan. The small plan shows the eastern end of the water system, with the masonry stairs in the inclined passage removed. The lines marked A–B to X–Y indicate the locations of the cross-sections in Fig. 3.

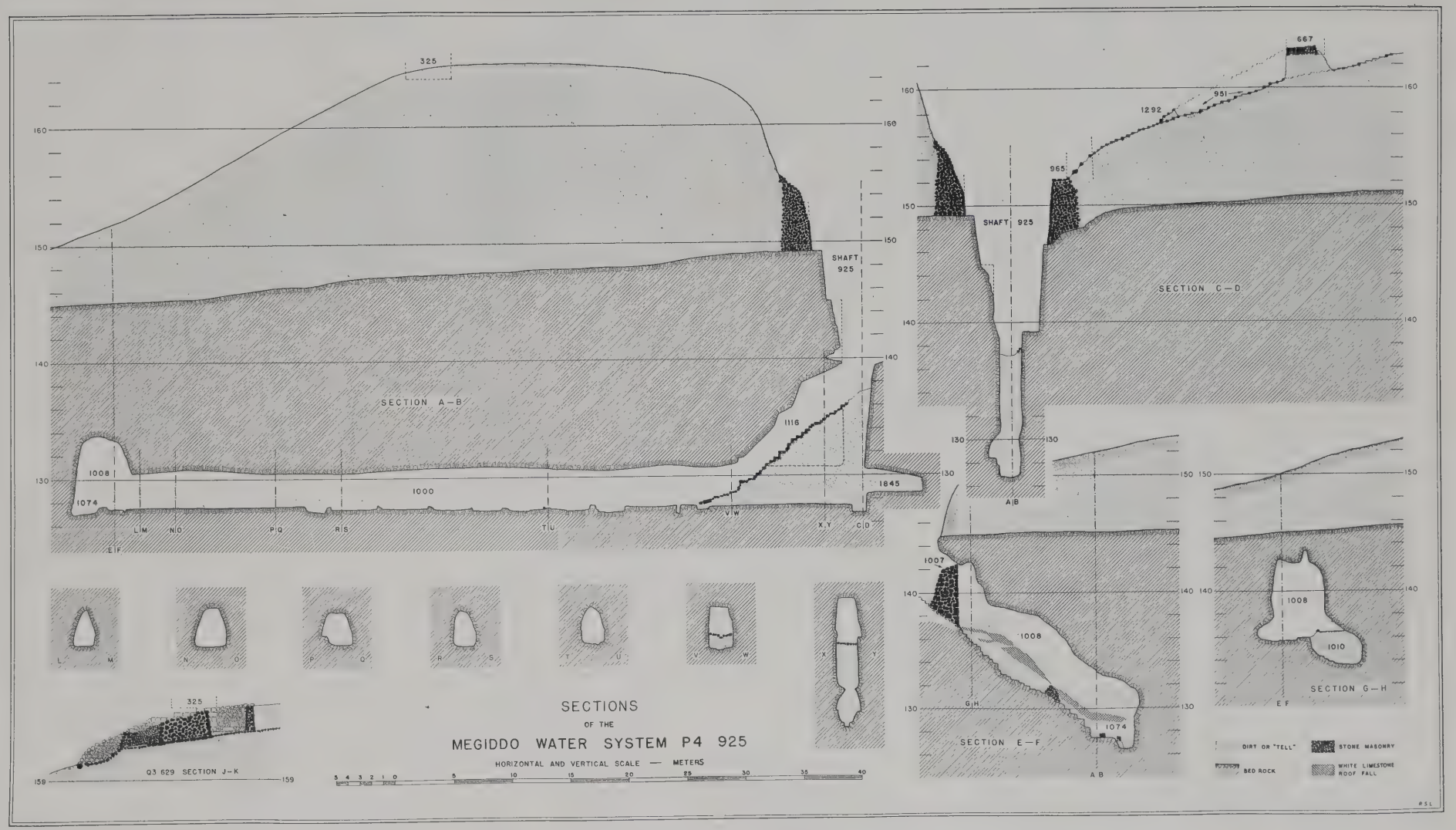

Fig. 3.—Cross-Sections of the Water System. Scale, 1:500
For locations of these sections see Fig. 2.

and so, at least during the early stages of the well, it is probable that the deepening was unwittingly brought about.

Once the water hole had become definitely a cave well—that is, had reached a point, say, just below the present location of the blocking wall, 1007 (which, of course, did not exist at that time)—it is probable that the cave was intentionally enlarged not only downward but also laterally. On the irregular floor of the enlarged cave the water, as it sank during the summer drought, would collect in pools, and the deepening of the cave would be concentrated on the largest of these accidental depressions. The cave, then, might quite conceivably have become

Fig. 4.—Cave 1010 with the Filling Removed. Cf. Fig. 6

a double-headed cave; that is, two independent wells might have been scraped out in the floor of the main cave. But now suppose that one of these subsidiary caves happened to be following—or nearly following—the fissure in the rock that had given rise to the original surface spring; the supply of water in the well on or near the fissure would be more abundant than that in the other subsidiary well, and therefore the better of the two would be enlarged and maintained, while the other would be abandoned. Cave 1010 (Fig. 4), which has rock-cut steps leading down into it, is thought to have been such an abandoned well; and certain other irregularities in the sides of the main cave may owe their origin to the same cause.

The great height of the main cave (5–7 meters) is largely due to the character of the rock out of which it is cut. The rock is soft, heavy-bedded limestone, which when dry is very friable and has a strong tendency to fracture, and when wet becomes quite plastic. The rock-cut steps in the floor of the cave were constantly wet, and the erosion by rain water running into

the cave, combined with the ordinary wear due to use, must have made necessary frequent repairs, effected by cutting the steps deeper. The roof of the cave, having been dry, has fallen away. When we cleared the cave we found a large quantity of fallen roof (Fig. 5; cf. Fig 3, section E–F), but it represents only the accumulation formed after the building of the blocking

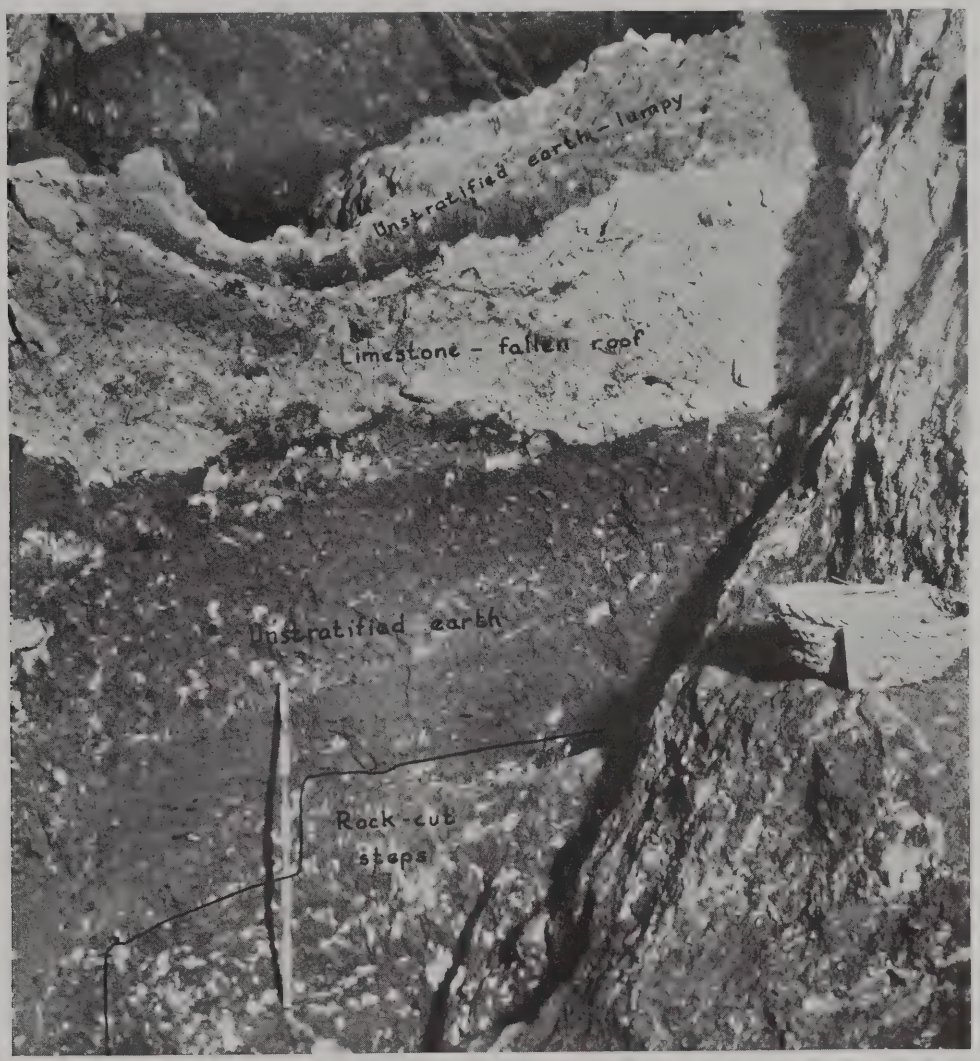

Fig. 5.—Cross-Section of Filling in the Main Cave (1008)

wall, 1007. A great deal of fallen roof must have slowly accumulated and from time to time been cleared away when the steps in the cave were still in use, before the outside entrance had been blocked. Thus the entire cave has suffered enlargement both upward and downward throughout its length.

The foregoing explanation of the origin of the cave complex necessitates a slow but considerable drop in the level of the ground water table; and such a change in ground water level calls for a drastic change in either climatic or physiographic conditions. It is recorded that the region about Megiddo, and indeed practically the whole of Palestine, was at one time well forested and that during the course of many years these forests were slowly destroyed by the

inhabitants, who used the trees for building and for firewood.[1] At present there is scarcely a tree in sight in the wide panorama from the summit of the mound of Megiddo. On one side we see the broad plain of Esdraelon, on the other the barren, glistening white limestone hills of the Carmel Ridge.

Forests cause a heavier precipitation of rain and tend to distribute that precipitation more evenly throughout the year; but in order to account for the change in the level of the ground water table it is hardly necessary to imagine any appreciable change in the annual rainfall. Suppose the annual precipitation to have been the same as it is at present, but imagine the hills of the Carmel Ridge, just behind the tell, well forested. With forests there must have been underbrush and an accumulation of dead leaves. All these things contribute to rapid soil formation, and the roots of vegetation prevent the soil from being washed away from the hill slopes. Therefore, if the forests did exist, these now barren hills must have been covered with a thick blanket of soil. Soil absorbs moisture and thus prevents rapid run-off of precipitation; and soil, as well as trees and underbrush, protects moisture from evaporation. These factors build up and maintain a high ground water table, and from such an underground reservoir the water is evenly distributed throughout the year by numerous springs. The removal of the forests around Megiddo caused the soil to be eroded from the hillsides; soil erosion came to exceed soil formation; and, since the height of the ground water table depends largely on the thickness of the protective blanket of soil, the ground water table slowly subsided.

It is interesting to note that the majority of the springs still in existence in Palestine are located at the foot of some ancient mound. Of course tells owe their location to the availability of water, but on the other hand artificial accumulation of soil in tells helps to preserve a higher ground water level under them than under barren rock hills.

THE GUARD'S POST

When cave 1008 had reached very nearly its present depth, the abandoned well 1010 was utilized as a dumping place for silt and scrapings dredged out of well 1074 during the annual or periodic cleaning process. The débris which we cleared from 1010 was for the most part hard packed and loamy and contained many cobbles, bowlders, and a large quantity of sherds both large and small—chiefly broken water jars. In the upper part of the deposit the filling averaged about one basket of sherds to every twenty of dirt, but the number of both sherds and stones decreased slightly toward the bottom and very noticeably toward the back. Layers of sandy, waterlaid material about 3 inches in thickness occurred every foot or so. The sandy seams were not continuous over the whole area but occurred in pockets, chiefly toward the back of the chamber. At the very back of the cave there were no sherds or stones, and the filling consisted entirely of finely laminated, waterlaid silt. This arrangement of the fill indicates that when mud mixed with stones and sherds, which was dredged from the well, was dumped in the front part of 1010, the watery mud ran down toward the back, leaving the stones and sherds concentrated in the front.

The small upper part of cave 1010 which remained unfilled was used as a guard's post or sentry box (Fig. 6). In the sloping roof, toward the front, were drilled several holes into which pegs had apparently been driven to support a lamp platform. Signs of burning still remain on the rock just above the holes. A rough rubble floor was thrown over the dump material, and

[1] There are numerous references in the Old Testament to the existence of forests and to the cutting of them. Likewise in the Annals of Thutmose III on the walls of the Karnak temple of Amon it is mentioned that "they measured this city (Megiddo), [surrounding it] with an inclosure, walled about with green timber of all their pleasant trees"; see Breasted, *Ancient Records of Egypt* II (Chicago, 1906) § 433.

FIG. 6.—THE GUARD'S POST (1010) BEFORE THE FILLING WAS REMOVED

A part of the blocking wall (1007) appears in the upper left-hand corner, and steps of the main cave (1008) are seen in the foreground.

FIG. 7.—THE SKELETON OF THE GUARD *in situ*

a rubble retaining wall was placed across the entrance to prevent the dump from finding its way back into the main cave, 1008. A large basalt bowlder with a concave upper surface, found near the entrance to the guard's post, makes an admirable seat. The remains of the guard himself, a man about thirty years of age, were found inside the shelter. Evidently he was the victim of a hostile attack on the well and met with sudden death. Carbonized fragments of his coarsely woven clothing were preserved by the constantly damp earth that covered the skeleton.

The skeleton (Fig. 7) was found lying on its right side, with the right leg and right arm flexed and the left limbs extended. The skull, lower jaw, both scapulae, and the upper six vertebrae were entirely missing.[1] The head and upper part of the body were toward the front of the cave, and it is therefore probable that the missing parts were exposed and routed out soon after death. The rest of the bones (except the left pelvis, left femur, and left humerus), including even the bones of the hands and feet, were perfectly articulated. The pelvis had been pulled out, dragging with it the femur and humerus, and subsequently reburied just above the rest of the skeleton. It is evident from the location and unusual position of the body (half flexed and half extended) that the deceased was not properly buried but, having met sudden death "with his boots on," was forgotten and left where he fell. A deposit of ash and charcoal shows that a fire occurred over the body. The location of charring on the bones indicates that the fire was heaviest over the upper part of the body but was general as far as the flexed right leg; that is, the fire was confined to the front part of the cave. Also, it is clearly seen that the fire took place before the bones were disturbed.[2]

THE GALLERY

The main cave (1008), as has been described (p. 1), in its early history was accessible only from the foot of the mound outside the city wall, and its entrance was entirely exposed. Later, however, an attempt was apparently made to conceal the mouth of the cave and to make the well accessible from within the city only. The previous internal supply of water, if any, must have (1) failed completely, (2) been considered inadequate, (3) been destroyed beyond repair, or (4) fallen to ruin and become buried during a period when the site was not occupied.

A small passageway (locus 629 in Q 3; see Figs. 2 and 3), originating well within the city, leads part way down the slope of the hill toward the entrance to the cave. It is substantially built of part ashlar and part rubble masonry and is floored with large, fairly well squared flagstones (Fig. 8). In all probability it was originally roofed over and buried, forming a tunnel or gallery some 2 meters high and slightly more than a meter wide. The west, or down-slope, end of the gallery is broken away and comes to no definite terminus. There is every indication that it once extended farther, and it may very possibly have connected directly with the mouth of the cave. If this is the case, it is likely that some remains of the lower end of the gallery are preserved under the as yet unexcavated area outside the blocking wall 1007.

[1] A mandible of an aged adult was found in 1010 near the skeleton; but, since the maximum age for the skeleton is about 30, it is not possible that this jaw belonged to the guard. Another mandible, found in the lower part of the main cave (1008), is that of a man aged 25 to 30 and may conceivably belong to the skeleton of the guard.

[2] The following parts of the skeleton were charred:

Left ulna—proximal end and middle
Left radius—distal end
Left clavicle—superior surface
Left femur—distal internal (slight)
Right femur—distal internal (opposite left femur)
Right tibia—middle internal (close to right femur)
Right humerus—proximal end
Right clavicle—superior and inferior
Right hand bones
Breast bone—anterior
Left ribs—anterior

The gallery was found immediately below the foundations of a 10th century (Solomonic) city wall (325). From such close proximity it might be inferred that, though the gallery is

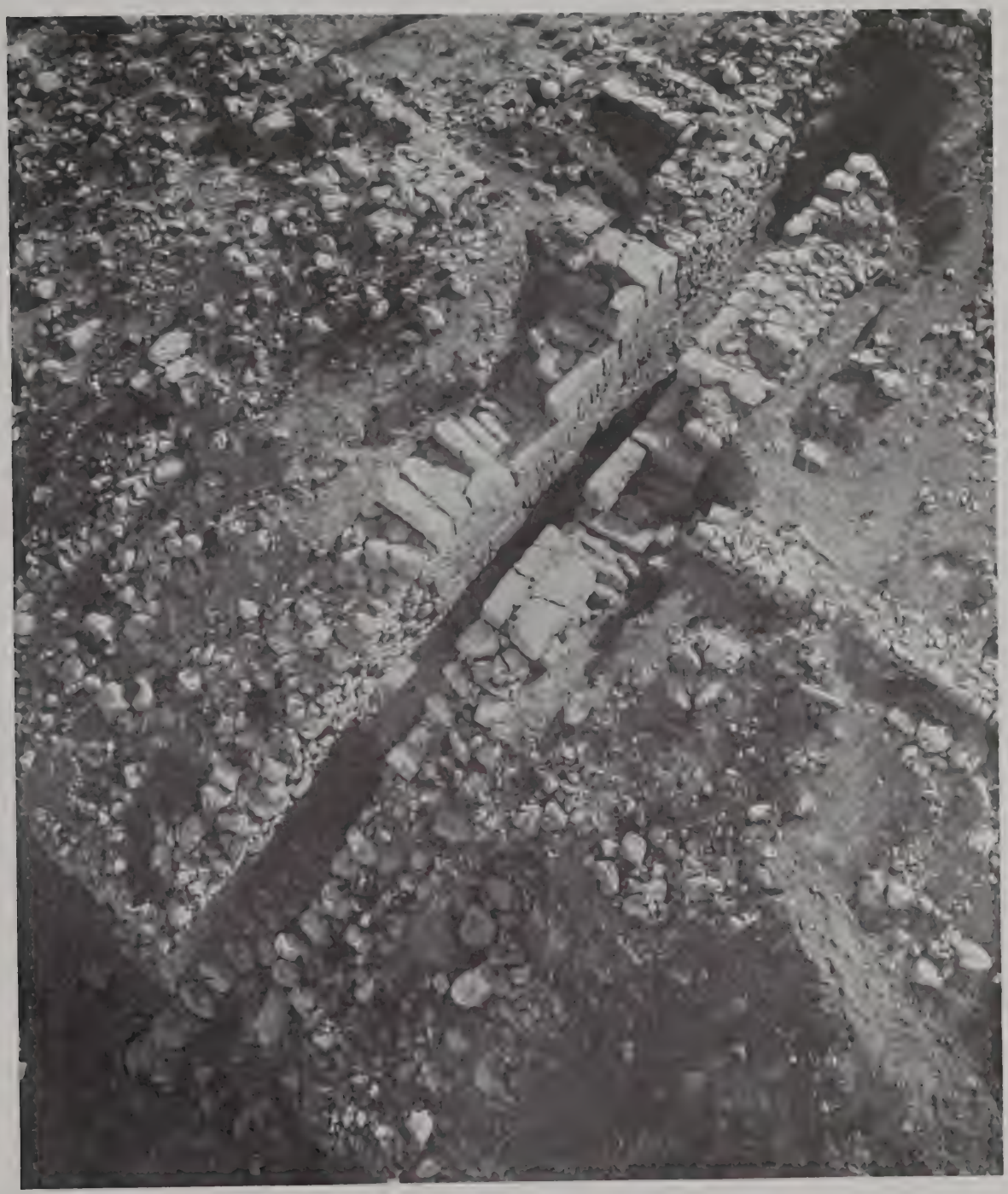

Fig. 8.—Upper Part of Gallery 629, from the Southwest

definitely earlier than the Solomonic period, it is not very much earlier. There was no pottery or other datable material directly associated with the gallery; but, if we assume that it was connected with the mouth of the well, its date can be indirectly determined by its relationship

to certain other parts of the water system for which there is direct dating evidence. Since it is almost certain that the purpose of the gallery was to give access to the mouth of the cave, it could not have been used after the outside entrance to the cave had been blocked by wall 1007. Nor would the guard's post, as such, have been of any use after the mouth of the cave had thus been completely blocked. Manifestly, both the guard's post and the gallery came into existence before and not after the construction of the blocking wall.

It is very unlikely that 1008 ever reverted to an open-mouthed cave, necessitating a guard or sentry, after the end of the gallery period. That is to say, the blocking wall was probably built almost immediately after the gallery ceased to exist, and therefore it is not likely that the guard's post was established *after* the gallery period. However, the guard's post may quite possibly have been brought into use *during* rather than before the gallery period; and indeed the lamp platform, though it may have been for the sole use of a night sentry, rather suggests that the chamber was occupied during a time when daylight was shut out from the cave. And too, that the filling under the floor of the guard's post, along with the associated pottery, was deposited at least in part during the gallery period seems plausible because of the fact that, at a time when the cave was entirely open, the utilization of this chamber as a dumping space would have effected only a slight saving in disposing of the silt periodically cleaned from the well; but after the gallery had been built this convenient dumping area would have obviated a long carry through the gallery up the side of the mound.

Certain of the pottery from under the floor of the guard's post is to be dated as late as the 12th century B.C. If we accept the foregoing arguments that the guard's post is either earlier than or partly contemporary with the gallery, this pottery determines the earliest possible date assignable to the gallery—that is, the 12th century.[1] As will be demonstrated later (p. 26), the blocking wall (1007), which has been shown to be post-gallery, was built during that same century. It appears therefore that the gallery can have existed only for a rather short time somewhere in the first half of the 12th century.

Since the gallery was built on, or rather in, the steep slope of the hill, it must certainly have been difficult to prevent it from becoming exposed during the rainy season, making it readily detectable and easily destroyed. Its destruction, of course, would have been disastrous. It is suggested that the guard may have met death when the gallery was discovered and destroyed by a hostile people.

The systematic blocking in the upper part of the gallery is described on pages 30 f.

THE SHAFT AND TUNNEL

While the masonry gallery had temporarily solved the problem of concealing the entrance to the cave and making the well accessible only from within the city, it apparently was not entirely satisfactory. It had been in existence only a comparatively short time before a far more elaborate scheme, affording infinitely better protection to the water supply, was carried out. It seems likely that the idea which led to the construction of the shaft (925) and the tunnel (1000) was suggested by the gallery (629).

The shaft and tunnel were constructed according to a definite plan carefully worked out beforehand, so that most of the difficulties were foreseen and allowance made for them before they were actually encountered. An analysis of the problems involved and the methods used in solving them exhibits remarkable forethought, resourcefulness, and logic, and probably

[1] Though it does not seem likely, it cannot be definitely proved that the guard's post was not established *after* the gallery ceased to exist—that is, during a period of indefinite length between the end of the gallery period and the building of the blocking wall. If this is the case, the earliest possible date of the gallery must be left indefinite.

considerable experience on the part of the engineer in charge of the work. The plan was essentially to sink a vertical shaft from the top of the mound within the city to the level of the lower part of cave 1008 and to connect the bottom of the shaft with the cave by a horizontal tunnel. The outside entrance to the cave was then to be completely blocked by a wall, the outer face of which was to be concealed by an earth filling.

The site of the shaft was chosen, probably in consideration of general convenience and protection, without sacrificing any possible conservation in the length of the tunnel. The upper

Fig. 9.—View down the Shaft from the North
Bed rock begins where the two figures stand.

part of the shaft, through the artificial part of the mound, must at first have been merely an irregular hole. The earth would not stand at a very steep angle, and the walls and pavements of earlier cities were constantly encountered. Parts of several buildings of earlier cities were left in the sides of the hole (Figs. 9–10), and we hoped that an examination of these loci would reveal what stratum was first encountered and thus determine the date of the shaft; but in this we were partially disappointed. Room 949 (see Fig. 10) contained large quantities of pottery of the Middle Bronze II period (Pl. III); and 952 (see Fig. 10), though it contained no datable pottery, stratigraphically seemed to belong to the same period. Room 1134 (see Fig. 2) also produced no datable pottery; but in 1133 (see Fig. 2), almost directly above it, was found pottery of the Late Bronze II period (Pl. I). Whether or not room 1133 belongs to the uppermost city encountered could not be determined; and therefore, from this evidence alone, it can

be said only that the shaft was probably built not before the latter part of the Late Bronze Age. While this is not very definite in itself, it does tend to substantiate other evidence (p. 26) which indicates a 12th century date for the construction of the shaft.

When the irregular funnel-shaped hole had penetrated through the tell and reached bed rock (see Fig. 9), the work of building thick retaining walls was begun. A staircase (965) was built along the inner sides of the walls. Dirt was packed behind the four walls as they rose toward the surface, thus filling in the irregularities and leaving a roughly square masonry

Fig. 10.—Rooms 949 and 952 of a Middle Bronze II City through Which the Shaft Penetrated

shaft. Staircase 951 is a later addition, for it is built through a breach in the original wall (Fig. 11; see p. 31). It is believed that the masonry shaft originally rose to the surface of the mound and that the steps 965 continued around the sides and emerged at the top of the shaft. After the completion of the retaining walls, or perhaps while they were being built, the shaft was extended down into the bed rock, and the stairs were continued along the sides of the rock-cut shaft as the work progressed (Fig. 12).

In the meantime the "Director of Public Works" of this ancient period was concerning himself with some rather nice problems of surveying. The two major problems confronting him at this time were (1) vertical control, that is, the means of determining when the shaft was deep enough so that a horizontal tunnel from it would intersect the lower part of the cave, and (2) horizontal control, or the means of determining the proper direction in which to orient

the tunnel so that it would emerge in the cave. There is no indication as to how the vertical distance from the cave to the top of the shaft was measured, but, since it is obvious that some instrument was necessary, I venture to suggest that a leveling device similar to one found at Thebes in the tomb of the Egyptian architect Sennozem (19th–20th dynasty) was used.[1] Once this distance was measured it was simple enough to plumb one straight measurement down the shaft.

The problem of horizontal control was less difficult of solution and required no instrument other than a plumb line. The location of a point on the surface of the ground directly above

Fig. 11.—View from the Northwest Showing Staircase 965, Incorporated along the Inner Faces of the Retaining Walls, and the Later Steps (951) Built through a Breach in the Original Wall

The edge of the concrete slab rests on the top of the bed rock.

the lower part of the cave (i.e., directly above well 1074) could have been estimated by eye with a degree of accuracy sufficient for the purpose in hand, but it is probable that it was ranged in as accurately as possible. An observer standing at the mouth of the cave would have been able to see both the well and the point on the ground directly above it at the same time. The problem involved making two distances equal; but, since the slope down into the well is about the same as the slope up to the point on the surface, the two distances would not have had to be reduced to horizontal. From this point on the surface, probably marked with a stake, a line of ranged poles or stakes was run to the center of the shaft by the simple method of extending the line between each two successive points by eye. Two points on this ranged line were plumbed down into the shaft, and the tunnel was properly oriented by back-sighting along the line determined by these two points. The shaft was oriented in such a way that the

[1] W. M. F. Petrie, *Tools and Weapons* (London, 1917) p. 42; Somers Clarke and R. Engelbach, *Ancient Egyptian Masonry* (London, 1930) Fig. 264.

FIG. 12.—VERTICAL VIEW DOWN THE ROCK-CUT SHAFT

The ancient stairs were largely destroyed, but their remains indicate that they followed approximately the line of the modern concrete steps.

diagonal between two corners fell along the ranged line, thus enabling the longest possible length of the line to be plumbed down the shaft, and of course the amount of accuracy attained in orienting the tunnel was directly proportional to the length of this line. This orientation of the shaft not only gives the clue to the method used in directing the course of the tunnel but also illustrates remarkable forethought on the part of the engineer.

The sides of the shaft are nearly vertical, but the staircase descending around the walls caused them to converge and the shaft to become increasingly narrower toward the bottom. Five flights of steps below the surface of the bed rock brought the shaft practically to its vertex at a point some 10 meters short of the required depth, the depth of well 1074. It was impossible to incorporate a staircase on the sides of a vertical shaft below this point of convergence (see Fig. 12); therefore the shaft was sloped, and the steps were continued along the bed rock floor of this sloping shaft or inclined tunnel (1116 in Fig. 2; see Fig. 3, section A–B). The original bed rock floor of the inclined tunnel was subsequently quarried away, and later the rock-cut steps were replaced by the masonry steps which are shown in Figure 3. Traces of the original rock-cut steps which were left in the sides of the passage (see Fig. 20) indicate that they were in approximately the same location as the later masonry stairs. A description of the eastern tunnel (1845) and its ramifications—under the inclined tunnel—with a discussion of the reason for its existence will be found in its chronological order on page 26.

The inclined tunnel was oriented in the direction toward the cave by back-sighting on the two points which had been plumbed down the shaft, thus extending the surface ranged line in reverse direction into the tunnel. To judge by the slope of the roof in the upper part of the inclined tunnel, it appears that the first plan—conceived only after the vertical shaft had unexpectedly reached its lowest limit—was to slope the tunnel gradually down until it emerged in the cave. This plan was soon abandoned and the angle of the tunnel increased to about 45 degrees. Presumably this was done in order to reach the required depth in as short a distance as possible and thus simplify the problem of vertical control, which even at best must certainly have been considerably complicated by the inclined tunnel.

When eventually a depth was reached which was, in the judgment of the engineer, at the same horizon as the predetermined point in the cave, horizontal tunneling was commenced. Actually, as is demonstrated below, the horizontal tunneling was started at an elevation slightly too high—an error of not more than a meter. Had the error been in the opposite direction—that is, had the inclined tunnel been dug too deep instead of not quite deep enough—the ground water table would have been penetrated and water encountered at the foot of the steps. It is probable that this would have been considered an adequate well and the horizontal tunneling to the cave been abandoned.

That the engineer was none too confident of the accuracy of his surveying is evident from the fact that allowance was made for error of closure in the horizontal tunneling. A small trial tunnel, approximately a meter and a half high and a meter wide was dug; thus any error which might exist, the amount and direction of which would not have been known until the shaft and cave were actually connected, could be corrected by enlarging the tunnel in the direction opposite to the error. This same procedure is common in modern tunnel engineering. As will be shown, what actually happened was that the sounding tunnel, originating at the bottom of the inclined tunnel, made an intersection with the cave at a point too high and too far to the south—a total error of about a meter. The tunnel was therefore enlarged downward and to the north. Had no error existed, it would have been necessary to enlarge the tunnel in all directions; and therefore correcting the error involved no extra work, nor did it make any very noticeable change in the size or shape of the final tunnel.

When the sounding tunnel had penetrated to a certain point (1 in Fig. 13), a tunnel was

started from the cave, and the work was carried on simultaneously from both ends. Since it was desired to have the final enlarged tunnel intersect the cave at a level just above well 1074,

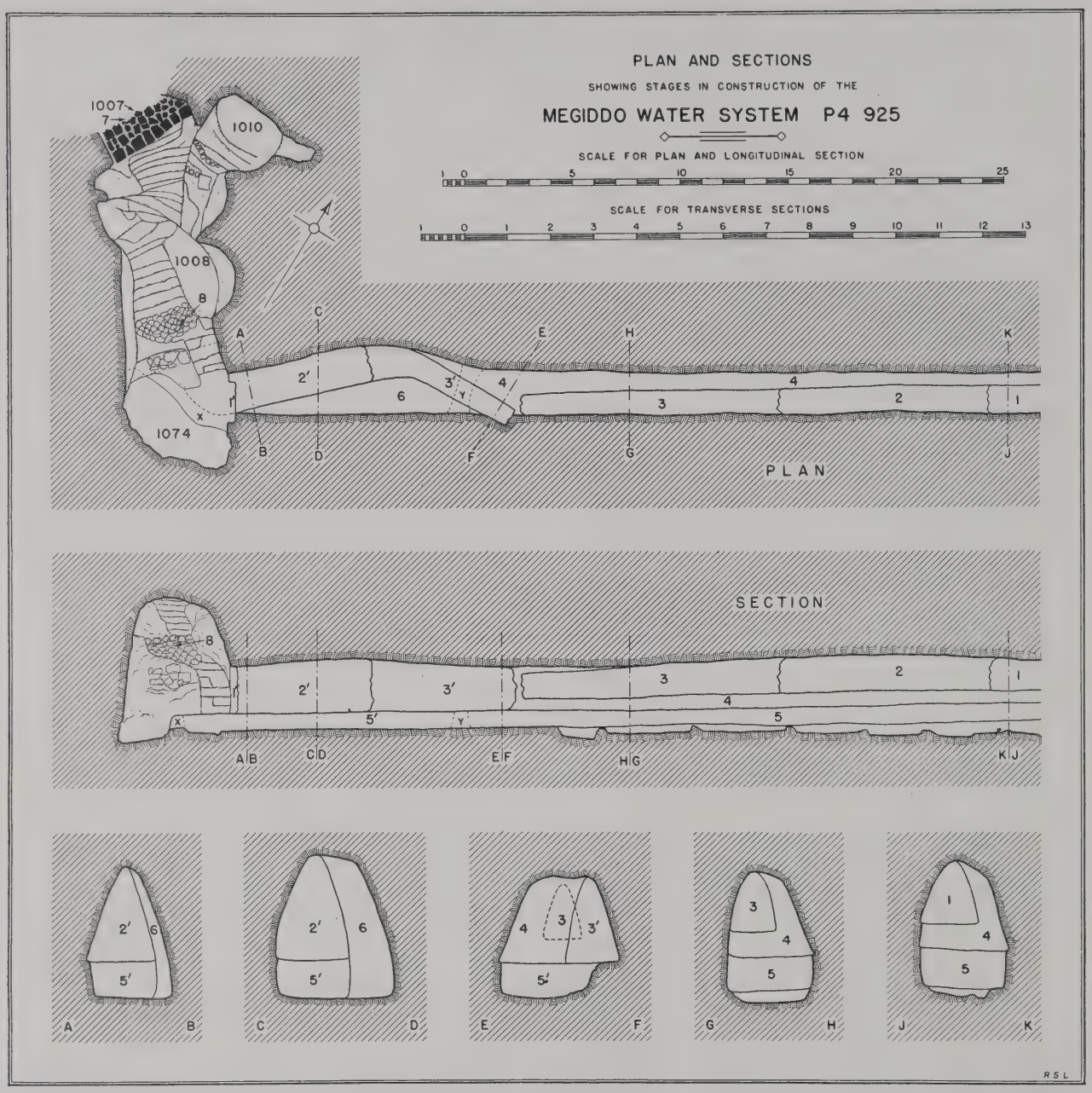

FIG. 13.—PLAN AND SECTIONS ILLUSTRATING THE VARIOUS STAGES IN THE CONSTRUCTION OF THE TUNNEL. SCALE, 1:300 (TRANSVERSE SECTIONS, 1:150)

The numbers 1 and 1′, 2 and 2′, etc., represent steps carried out simultaneously; and their sequence corresponds to the order in which the steps were executed. Note that sections A–B, C–D, and E–F are drawn facing east, while the other two face west.

the tunnel originating in the cave was excavated to its full height, and any vertical error of closure in the joining of the two tunnels was to be corrected entirely by an upward or downward enlargement of the shaft-end sounding tunnel. The orientation of this western tunnel

was difficult, in that it was impossible to introduce the surface ranged line into the cave by any direct method such as had been used at the shaft end. It is probable that a certain amount of guesswork was used in determining the proper direction. The engineer must certainly have realized the possibility of inaccuracy in orienting the cave-end tunnel, but he neglected to allow for a horizontal correction until after an error was actually discovered. One start was made (1′ in Fig. 13); and later, owing either to further calculations or what was thought to be a better guess, the mouth of the tunnel was shifted slightly and the work carried on in the direction indicated by 2′ in Figure 13. When the work had reached the stages indicated by 2 and 2′, no doubt the two parties digging toward each other could hear the sounds made by the opposite diggers. According to the Siloam inscription the workmen in the tunnel there did not hear the picks of the opposite digging party until they were within 3 cubits (1.34 meters) of each other.[1] This seems a remarkably short maximum distance for sound to be heard through rock—especially in the soft, marly limestone at Megiddo. We have observed while working in the rock-cut tombs on the eastern slope of Megiddo that about 15–20 meters, the distance from 2 to 2′ in Figure 13, is not too far to expect the sound of picks to have traveled. When these sounds were heard, it was realized that the two tunnels were not similarly oriented and that if continued in their respective directions they would not meet. Therefore the western tunnel was turned in the direction from which the sound seemed to come, and at the same time its width was decreased in order to allow for a horizontal correction. This stage of construction is indicated by 3 and 3′ in Figure 13. When the tunnels joined, the necessary correction became obvious, and the sounding tunnel was enlarged as indicated by 4.

Though part of the evidence is of a rather obscure nature, all the foregoing steps in the construction of the tunnel are well substantiated. The northward bulge in the tunnel near the cave end (Fig. 14) is fair indication of the original faulty orientation 2′; and the indentation in the south face (Fig. 15), where the two tunnels joined, is ample indication that the direction was changed as marked by 3′. In the ceiling the apex of the original tunnel is preserved at intervals throughout its length; and by this the change in direction from 2′ to 3′ is clearly seen. The latter could not be shown in the drawings, except in the transverse sections in Figures 3 and 13, but it shows fairly well in Figures 14 and 15. A comparison of the dimensions of the tunnel where it enters the cave with those where it overshot the mark at the joining place shows that 3′ was narrower than 2′ (see Fig. 13, sections A–B and E–F). Ledges along the sides of the tunnel appear to be remnants of former floor levels. They are best illustrated in the transverse sections, where also it will be noticed that a previous floor is often marked by a distinct change in the angles of the sides. The evidence for the widening of the tunnel lies chiefly in the shapes of its cross-sections. It will be noted that the apex of the eastern part of the tunnel is well over to the south side, that the south wall is much more vertical than the north, and that the ceiling slopes down to the north. It is assumed, of course, that this off-center apex was centered on the original sounding tunnel and therefore indicates a northward enlargement. In the part of the tunnel west of the joining place the conditions are reversed, indicating a southward enlargement. The shape of the tunnel shows best in Figures 16 and 17 and in the transverse sections in Figure 13.

Presumably the tunnel was considered finished after the sounding tunnel had been enlarged, that is, after the work indicated by 4 in Figure 13 had been completed; but, either as an immediate afterthought or as an idea evolved through use of the tunnel (probably the former),

[1] A. H. Sayce in Palestine Exploration Fund, *Quarterly Statement*, 1881, p. 149; Davis in Palestine Exploration Fund, *Quarterly Statement*, 1894, p. 272; and several other translations, all of which agree as far as the item of 3 cubits is concerned.

FIG. 14.—TUNNEL 1000, LOOKING EAST FROM THE WELL
The meter stick indicates the point where the two ends of the tunnel met.

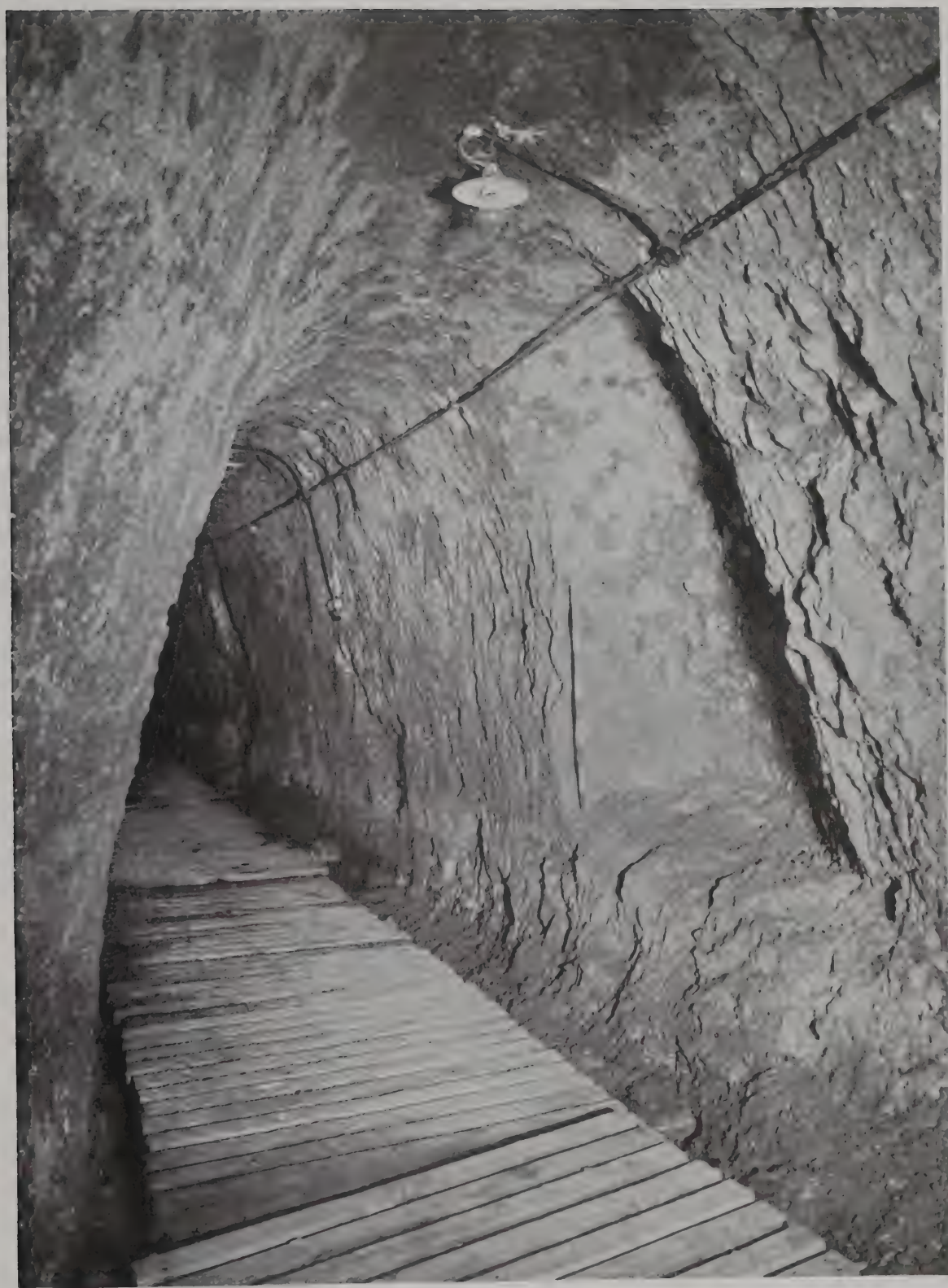

Fig. 15.—Indentation in the South Face of Tunnel 1000, Marking the End of the Western Section Where It Joined the Eastern Sounding Tunnel

it was decided to lower the floor and make an underground canal. Such a canal would allow the water from the established well 1074 to flow to the bottom of the shaft and thus eliminate the long dark walk through the tunnel. In order to lower the floor of the tunnel below the level of the water standing in the well it was necessary to leave a dam of rock (*X* in Fig. 13) between the well and the tunnel. While the dam may have held back a certain amount of water from the working area 5′, it is probable that considerable trouble was encountered from water seeping into the excavations. Since the well is located on a fissure in the rock and water

FIG. 16.—VIEW THROUGH TUNNEL 1000 TOWARD THE WELL

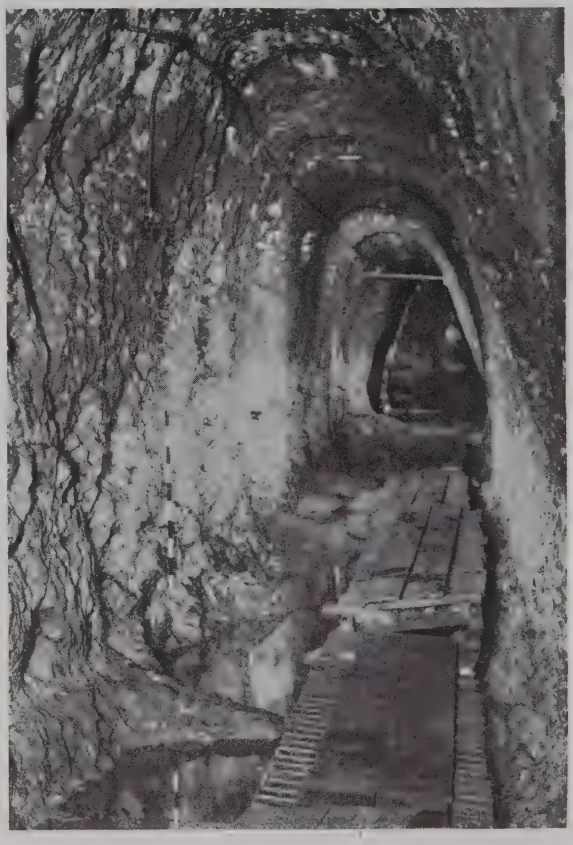

FIG. 17.—VIEW THROUGH TUNNEL 1000 TOWARD THE WELL

actually flows out into the pool at a detectable rate, it might be termed an underground spring; however, any hole dug in the tunnel penetrates the ground water table and fills with water to a level only slightly lower than the surface of the water standing in the well. And, too, at various points along the tunnel are to be found other fissures giving rise to "springs." Despite all efforts to impound the water, the lowering of the floor must have been done under rather wet conditions.

After the floor in the western part of the tunnel had been lowered, that is, after 5′ had been completed, a second dam was left (at *Y*), and the work of digging the canal in the eastern portion was continued (5). While this was being completed, the cave end of the tunnel was straightened by removing the bulge on the south face (6 in Fig. 13). This was done probably in an attempt to conceal the error made in orientation and also to facilitate lighting the tunnel. That the south wall was straightened *after* the floor had been lowered (i.e., that 6 followed 5′)

is shown by the fact that no indication of a higher floor level is to be found on the south wall. And if the reverse had been true, it is difficult to see why the floor in the northern bulge should have been lowered at all. Instead there would have been a ledge, as there is in the indentation where the tunnels joined (cf. Fig. 15). All the work of the tunnel seems to have been executed by two separate groups of men working simultaneously. Probably those in the western part utilized the short carry out through the original entrance to the cave, while those in the eastern portion disposed of their chippings through the shaft entrance. At the completion of both 5 and 6, the dams were broken through and the water from the well (1074) was allowed to flow to the foot of the inclined passage. The proximity of the place where the underground canal was opened (dam *Y*) to the place where the two tunnels originally joined rather suggests that, unless it was purely a coincidence, a ceremony was held on each occasion; but the inscription that one would expect to find in commemoration of such auspicious occasions has not been discovered.

A search has been made for signs of chippings which might represent the vast amount of rock chipped out from the shaft and tunnel, but none has been found. This is not very surprising, because any large blocks of stone that may have been quarried were doubtlessly used in building construction; and the majority of the material, especially that cut out of the lower part of the system, was so soft and water-soaked that it was probably more like mud than stone. In some parts of the tunnel the rock is so soft that it can be cut like cheese. In later times at least this soft marly limestone was specially quarried and used for making lime pavements.

THE BLOCKING WALL

The blocking wall (1007), built probably immediately after the completion of the tunnel, is of crudely coursed stone masonry. The most notable feature is the enormous size of most of the bowlders used in its construction (Figs. 18–19). The rough, weathered appearance of the stones on the inner face indicates that they were not freshly quarried for the wall, and it is very unlikely that they were transported any great distance. The inference is that the stone was taken from the ruins of the gallery (629), one end of which was presumably conveniently located at the entrance to the cave. The wall was built from the outside by the simple method of rolling the stones down the filling, which was kept level with the top of the wall; and thus, when the wall was completed, its outer face and the entire original entrance to the cave were completely concealed. The chinks between the stones on the lower part of the inner face of the wall were filled with mud plaster; but the upper part, being out of convenient reach, was left unplastered. Finger marks were preserved on the mud plaster, indicating that the pointing was done by smearing the mud on by hand (see Fig. 19).

After the blocking of the outside entrance the upper part of the cave, being useless for any other purpose, was used as a dumping place for the silt periodically cleared out of the well. A rough retaining wall (8 in Fig. 13) was thrown across the lower part of the cave to prevent the dumped material from slumping back into the well. The débris found in the cave was dirt interstratified with crushed limestone. The upper part of the deposit consisted of lumps of laminated, waterlaid silt; the lower part—below the limestone—was of similar character, but the lumpy appearance had been obliterated by the weight of the overlying deposit (see Fig. 5).

The deposit in the main cave (1008) contained a large quantity of pottery fragments. Comparison of these sherds with those found below the floor in the small cave 1010—under the guard's post—dates the construction of the blocking wall to within fairly close limits. If we

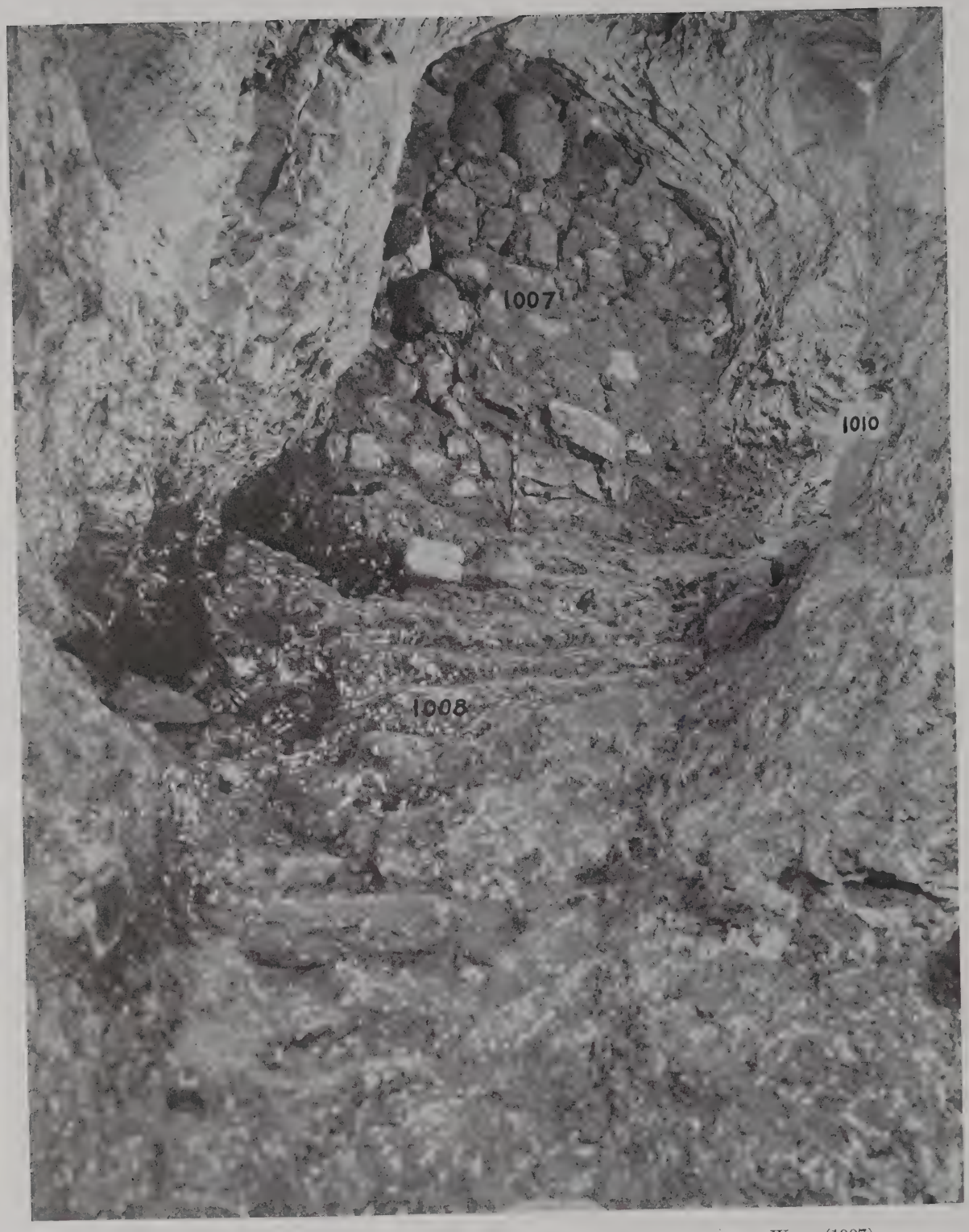

Fig. 18.—Looking Up through the Main Cave (1008) toward the Blocking Wall (1007)

Fig. 19.—The Blocking Wall (1007)
Note the finger marks on the mud pointing.

accept the assumption that, for safety's sake, the blocking wall was built immediately after the completion of the shaft and tunnel, then they too are dated by this same evidence. As was pointed out before (p. 12), the guard's post, as such, would have been useless after the blocking wall was built. The steps in the main cave could not have been obstructed until after the cave had ceased to be used as a passageway, that is, until after the shaft and tunnel had been completed. Thus the pottery from under the floor of the guard's post (1010) is earlier, and the pottery from the filling obstructing the main cave (1008) is later, than the blocking wall, tunnel, and shaft, which we assume are all contemporary. But both the latest pottery from under 1010 and the earliest pottery from the filling in 1008 (see Pls. I–II) are of the 12th century B.C., on the basis of similar Early Iron I forms and decorations found not only at Megiddo (Stratum VII) but also at other well stratified sites in Palestine. The dating of Stratum VII, and therefore also the dating of this significant water system pottery, has been well corroborated and to a certain extent delimited by the discovery of a bronze statue base bearing the cartouches of Ramses VI. Therefore the blocking wall must have been built during the 12th century and should probably be attributed to the middle of that century.

THE EASTERN TUNNEL

At some period prior to the 11th century B.C.—how long before cannot be determined—the bed rock floor of the inclined tunnel was cut away. The plan was, essentially, to extend the horizontal tunnel (1000) in an eastward direction under the steps of the inclined tunnel and then to continue the vertical shaft down to meet the end of the eastern extension (1845 in Figs. 2–3). Obviously, this operation would make the lower part of the water system inaccessible from the shaft except by means of a rope or ladders. Apparently the idea was to bring the water via the underground canal into a sump at the bottom of the vertical shaft and to lower receptacles by means of a rope and thus dip the water out as is done in an ordinary well.

In order that the inclined passage might be used for carrying out as much of the chippings as possible, the eastern tunnel (Figs. 20–21) was completed before the vertical shaft was extended. In determining the length of horizontal tunnel necessary to bring its end directly below the bottom of the vertical shaft, the engineer made a very costly mistake. Apparently the length of the eastern tunnel was made equal to the length of the inclined passage; that is, the distance *A–B* (Fig. 22) was thought to be equal to the distance *A–C*. This glaring mistake would rather lead one to imagine that the work was executed by someone other than the builder of the original parts of the water system. After the shaft had intersected the tunnel—indicated by broken lines in Figure 22—the sump was dug out; and the floor, which had been temporarily left at a high level to prevent water from interfering with the major part of the operations, was lowered and the water allowed to flow into the sump. For some reason, not quite clear, the triangle of rock formed by the eastern tunnel, the inclined tunnel, and the vertical shaft was subsequently removed, leaving only projecting remnants of the original roof over the eastern tunnel (see Figs. 20–21).

POSSIBLE EARLIER DATE OF THE SHAFT AND TUNNEL

We have assumed so far that the shaft (925) and the tunnel (1000) were contemporary with the blocking wall (1007). Though this assumption is probably correct, it must be pointed out that the cave may have been left open for some time after the completion of the shaft and

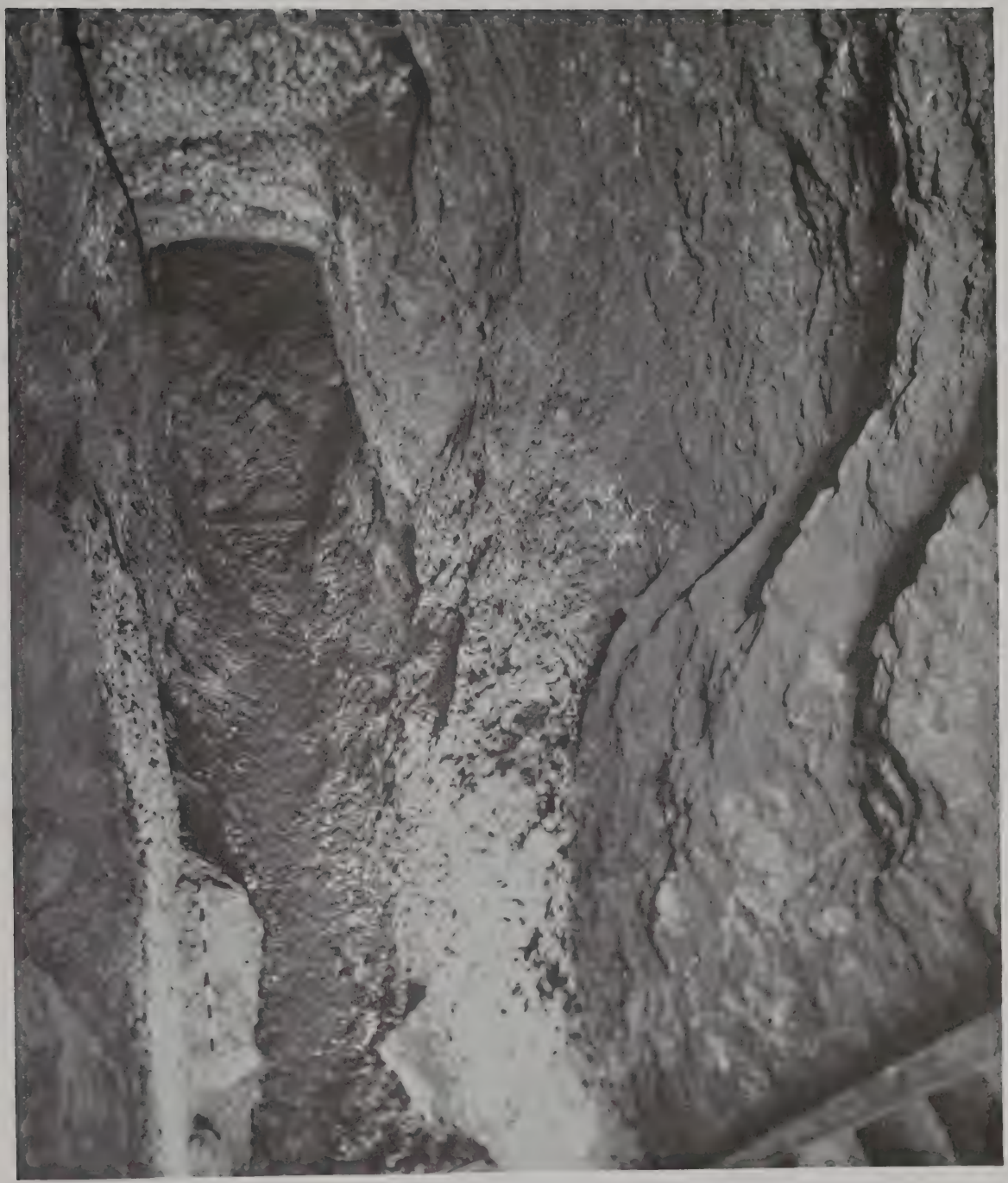

FIG. 20.—THE EASTERN TUNNEL (1845) BELOW THE MASONRY STAIRS OF THE INCLINED PASSAGE (1116), FROM ABOVE

The meter stick rests on a remnant of the destroyed roof over the tunnel. Remains of four rock-cut steps of the original inclined tunnel are visible at right.

Fig. 21.—The Eastern Tunnel (1845) and the Lower Part of the Vertical Shaft, from the West

tunnel. Comparison of pottery found in the main cave with that found under the floor of the guard's post dates the blocking wall quite definitely, but it does not preclude the possibility that the shaft and tunnel were in existence at an earlier date. Manifestly, some means of preventing a hostile people from entering the city via the water system must have been provided immediately after the passage was made accessible. Blocking the mouth of the cave was the obvious method, but let us suppose that for some reason it was desired to leave the cave open. The next best method of cutting off this line of approach would have been to scarp the eastern end of the water system as described above.

The theory that the cave may not have been immediately blocked and that the shaft and tunnel may therefore be dated earlier than the blocking wall has the advantage of affording an explanation of why the entire floor of the inclined tunnel was cut away instead of leaving

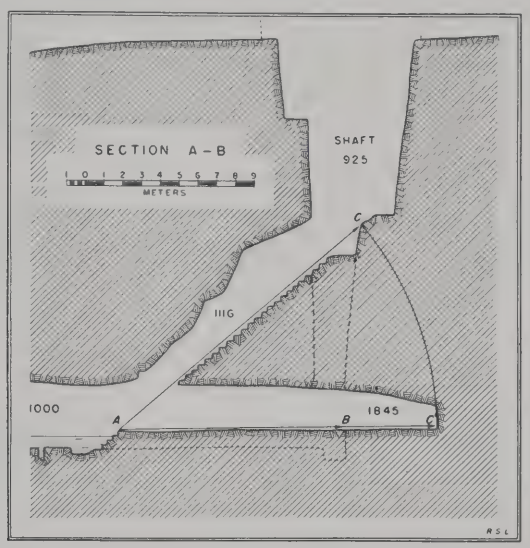

Fig. 22.—Section Showing Eastern Tunnel (1845) and Inclined Passage (1116)

the triangular mass of rock referred to above. If the eastern end of the system was intentionally scarped to prevent access to the shaft from the tunnel it would have been prudent to remove the whole inclined tunnel, as was done. There are, however, several facts against this theory: (1) It seems incredible that, after having gone to such pains to protect their water supply, the builders of the shaft and tunnel left the cave open and accessible to any hostile people who, though they could not enter the city through the tunnel, could enter the cave, use the water, exhaust the supply, dam the canal, or even pollute the water. (2) The execution and workmanship of the blocking wall is comparable with that of the shaft and tunnel, but the blunder made in the tunneling operations below the inclined passage does not seem to be in keeping with the excellent engineering exhibited in executing the rest of the system. (3) It will be recalled that the shaft apparently cut through a Late Bronze II locus; therefore, in any event, one would hesitate to date the construction of the shaft and tunnel earlier than the latter part of the 13th century B.C. It seems logical to conclude that the shaft was probably contemporary with the blocking wall and that the floor of the inclined passage was cut away at some subsequent time.

THE BLOCKING IN THE GALLERY

The upper part of the gallery (629) which passed under or through the city wall was effectively blocked to prevent its being used for gaining access to the city. City wall 325 (see Fig. 2)

Fig. 23.—Gallery with Blocking Walls in Position. Cf. Fig. 8

is a Solomonic wall and therefore was built some two centuries later than the gallery; but it is reasonable to assume that a city wall contemporary with the gallery crossed it at very nearly the same point, that is, over the ashlar masonry part of the gallery (see Fig. 3, section J–K, and Fig. 8). A rubble blocking wall, some 4 meters thick, centered on the ashlar masonry and was apparently directly below the old city wall. Two thin blocking walls were built equidistant

from either side of the thick wall (Fig. 23); the space between the outer thin wall and the central wall was filled with small stones, while the corresponding inner space was filled with earth. Presumably the thick, heavy blocking wall was centered beneath the city wall, and the spaces on either side of it were filled by pouring finer material through holes made in the roof of the gallery on both sides of the city wall.

LATER ADDITIONS TO THE WATER SYSTEM

The water system was used more or less continuously until the last occupation of the mound. The stairs 951, which were built through a breach in the original masonry shaft, emerge at the top of the tell at the level of the Stratum II city, which existed during the 7th century B.C.

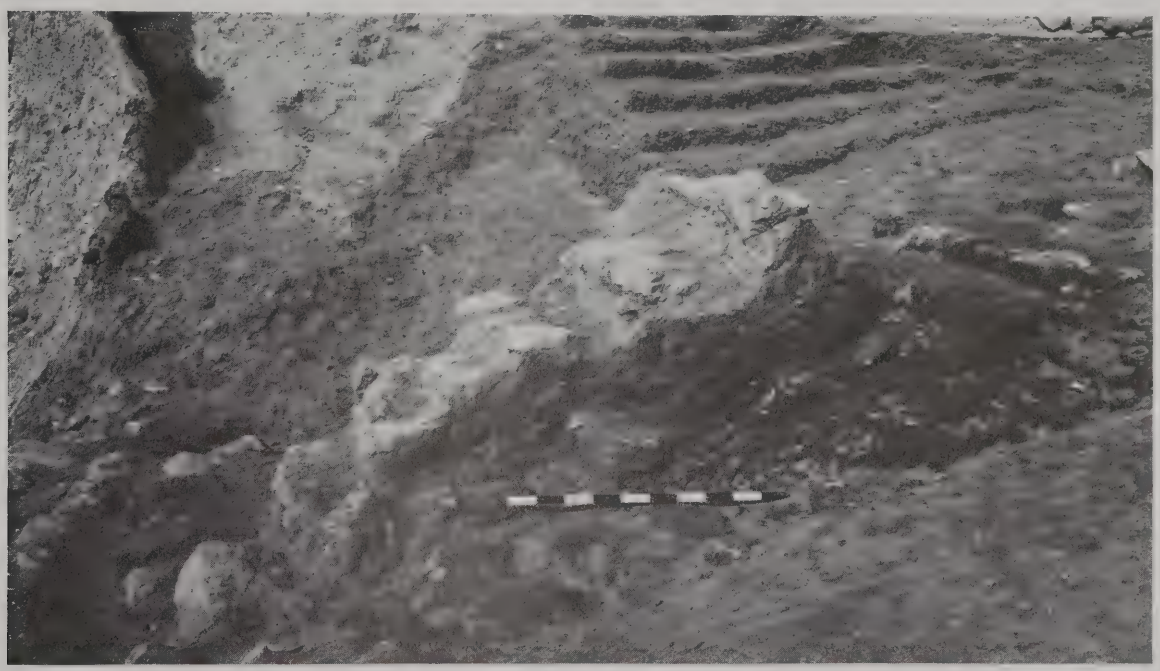

FIG. 24.—STAIRCASE 1292 BUILT OVER STAIRCASE 951. CF. FIG. 11
The stairs in the background are modern.

A short flight of steps (1292) built over 951 (Fig. 24), if extended, would reach the top of the retaining wall 667 (see Figs. 2–3), which with its continuation (946) belongs to the Greco-Persian period—the latest occupation of Megiddo. The sherds found in the filling which we cleared from the shaft were of practically every period represented in the mound, but there was a distinct predominance of pottery belonging to the later periods—mostly post-Solomonic. A fragment of Attic ware (Pl. VIII 31) was found in the shaft, 13 meters below the original surface of the mound.

At some time, probably during the later history of the water system, a wooden platform was built over the well (1074). No doubt holes through which water jars could be lowered were provided in the platform. The wall which divides the well into two parts and the several squared stones shown on the plan (Fig. 2) were all for the purpose of supporting this platform (Fig. 25). Some five or six niches cut in the rock sides of the well, level with the tops of the wall and the stones, were made to receive the ends of the beams supporting the platform.

Fragments of these wooden beams, untrimmed logs, were preserved in the constantly wet mud at the bottom of the well.

The two irregularities in the floor of the western part of the tunnel, one where the two tunnels originally joined (Fig. 26) and the other just south of the mouth of the tunnel near the well, are remnants of dams *Y* and *X* respectively (see pp. 22 f. and Fig. 13). When the

Fig. 25.—Well 1074 from Above

The mouth of the tunnel and the lower part of the steps in the main cave are seen at left.

dams were broken through to flood the tunnel, it was difficult to make a clean job of removing the submerged rock, and part of it, represented by these irregularities, was allowed to remain. Irregularities in the floor of the eastern part of the tunnel (see Fig. 17) are dams cut at a late period, when, since the ground water table had continued to sink, the tunnel had ceased to function as a canal except during the winter rainy season. As the water sank during the dry summer months, these dams were used to impound the water as near as possible to the foot of the masonry steps in the inclined passage. Two indentations in the north wall of the tunnel near the foot of the steps are merely breaks caused by local fractures in the rock and have no significance whatsoever.

The masonry stairs in the inclined tunnel (Figs. 27–28) were evidently built during a time of general repair at the beginning of the Solomonic period (cf. p. 17). In the filling below the

Fig. 26.—Tunnel 1000, Looking East toward the Inclined Passage
The irregularity in the floor is a remnant of dam *Y*.

stairs were found a number of fragments of Solomonic pottery and a mixture of pre-Solomonic sherds with late 11th century fragments predominating. There are indications that the water system was allowed to lapse into disuse and become silted up during the time just prior to the Solomonic period. A row of five units of stables facing on a courtyard or parade ground some

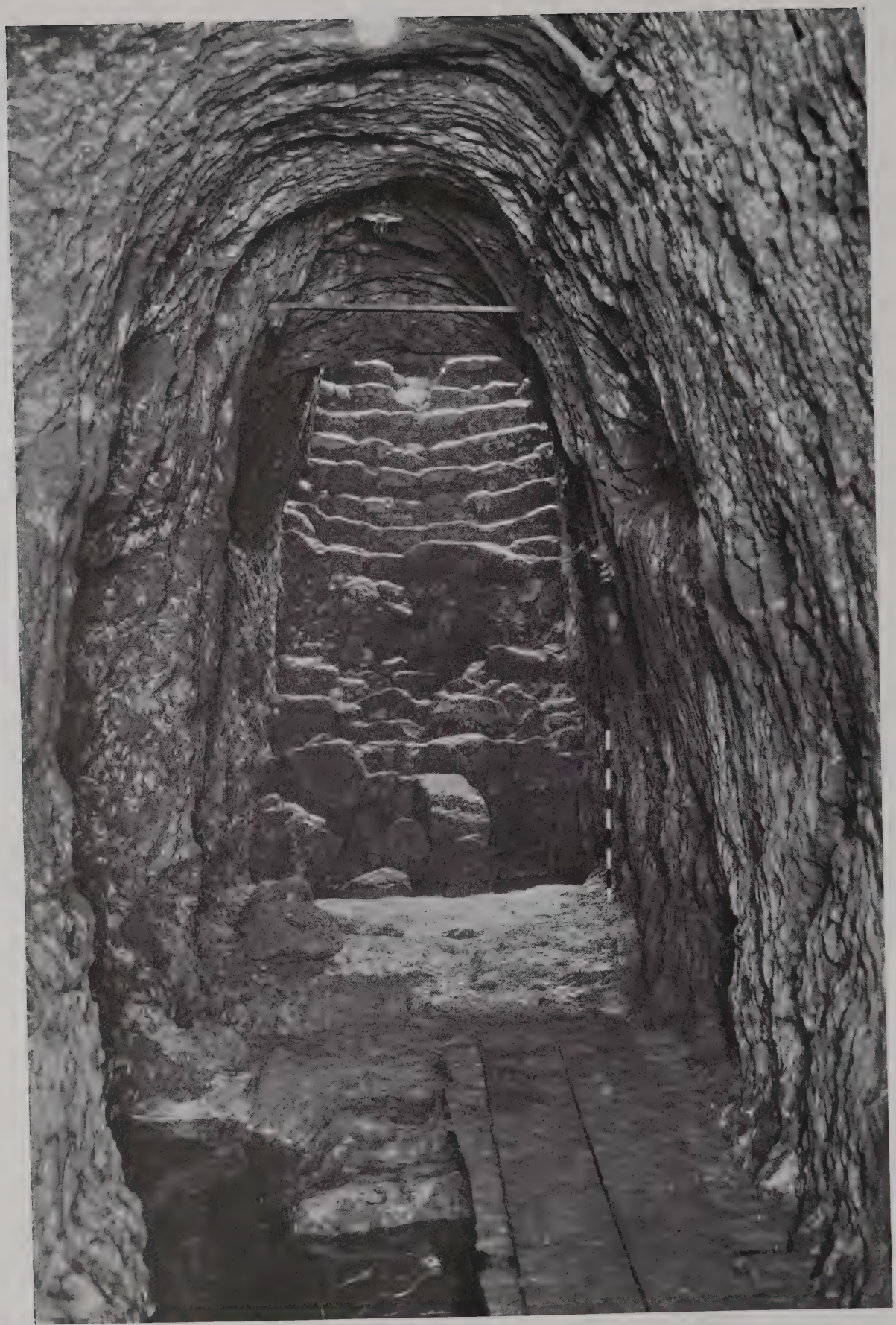

Fig. 27.—The Eastern Part of Tunnel 1000, Showing the Masonry Steps in the Inclined Passage

56 meters square is Solomonic in date and is located just east of the shaft of the water system. This compound is built on a deep filling which was artificially made for the purpose of leveling off the area. In searching for the source of such an enormous quantity of material, we con-

FIG. 28.—THE MASONRY STEPS IN THE INCLINED PASSAGE, FROM BELOW

cluded from the almost complete absence of stone that it could not have come from the mound. The fact that the majority of the sherds found in the fill are of one period—late 11th century B.C.—did not seem to fit the theory that the material was brought in from the fields surrounding the tell. The only theory that satisfactorily explains (1) the absence of stones in the fill, (2) the fact that the majority of the sherds in the fill are of one period, and (3) the fact that

the majority of the pottery fragments found in the filling under the masonry steps in the inclined tunnel of the water system are of that same period is that the silted-up water system was cleared at the beginning of the Solomonic period and that the débris thus obtained was utilized for making the stable courtyard filling. The earth in the lower part of the shaft, below the inclined passage, was allowed to remain, and the masonry stairs were built upon it. Probably the necessity for disposing of the large quantity of earth cleared from the water system was the chief reason why the courtyard was built up and leveled off.

SUMMARY OF DATING

Main cave (1008)	Slowly evolved from an indefinitely early period
Gallery (629)	Before the blocking wall (1007), probably early 12th century B.C. but possibly earlier
Guard's post (1010)	Early 12th century
Shaft (925) and tunnel (1000)	Contemporary with or earlier than the blocking wall (1007). Probably middle of 12th century
Blocking wall (1007)	Middle of 12th century
Eastern tunnel (1845)	Pre-11th century, possibly before the blocking wall (1007)
Masonry stairs in the inclined tunnel (1116)	10th century, Solomonic
Stairs 951	7th century
Steps 1292	Greco-Persian period (4th century)

CONCLUSIONS

There is little doubt that provision was made for a supply of water inside the city previous to the beginning of the 12th century B.C. During the siege of Thutmose III, Megiddo was entirely surrounded by a stockade and none of the inhabitants was allowed outside the city wall.[1] The siege lasted for seven months,[2] and for a garrison of the size of that at Megiddo to have held out for so long a period there must have been an abundant supply of water within the city. Again, during the Amarna period, Megiddo was harassed and several times attacked by the Habiru, who managed to take Taʿanach, a sister city, but were unable to overcome Megiddo. It would seem, then, that at that time too there was a good internal supply of water, for apparently the inhabitants were unable to leave the city limits.[3] The water supply used at this time was probably the same one which existed during the Thutmose siege.

It is impossible to account for the abandonment of this earlier water supply, but it must have failed or otherwise disappeared and been forgotten by the time of Ramses III, for it seems most likely that the gallery was built during his reign. On the basis of pottery associated with the bronze statue base bearing the cartouches of Ramses VI (see p. 26) we assign to the latter the cutting of the shaft and tunnel and the building of the blocking wall. Then, since the evidence indicates that the gallery period was short and that the interval between the destruction of the gallery and the construction of the shaft and tunnel was also short, it seems logical to postulate that Ramses III was responsible for the gallery.

When Egyptian power in Palestine waned because of internal troubles in Egypt, Megiddo was no longer maintained as a fortress, and eventually it dwindled to an ordinary unfortified, probably agricultural, settlement (Stratum V). The fortifications fell into disrepair, and the water system was allowed to become silted up.

[1] Breasted, *Ancient Records of Egypt* II, § 433.

[2] G. A. and M. B. Reisner in *Zeitschrift für ägyptische Sprache und Altertumskunde* LXIX (1933) 31–32.

[3] J. A. Knudtzon, *Die El-Amarna-Tafeln* (Leipzig, 1915) No. 244.

This state of affairs seems to have existed until the early part of the 10th century B.C., when perhaps David, in his efforts to make a united Israelitish empire, built a small outpost fort or citadel on the high ground in the south central part of the mound. This citadel may equally well be attributed to the early part of Solomon's reign, for it had scarcely been properly finished and occupied, it seems, before the great Solomonic fortifications were commenced. Stone from the citadel was used for building the city wall, and the water system was repaired and cleared of the accumulated silt. This initiated a long period which, with a certain amount of rebuilding from time to time, lasted until the latter part of the 9th century B.C. During the early part of the succeeding period the Solomonic fortifications were maintained, but during the latter part the city wall and the water system were allowed to fall into ruins.

FIG. 29.—DEPRESSION OVER THE SHAFT OF THE SILTED-UP WATER SYSTEM, SHOWING SERIES OF RUBBLE PAVEMENTS THROWN ACROSS IT

The city appears to have been rebuilt and the fortifications repaired to a certain extent during the time of Josiah. To this period is to be attributed the long flight of stairs (951) which led down through a breach in the original masonry shaft of the water system. The history of Megiddo subsequent to this time is hard to define, and all that can be definitely stated is that the site ceased to be occupied at about 350 B.C. During the last stages of sporadic occupation the water system was allowed to silt up again. Eventually it became merely a depression in the top of the mound, which, during the rainy season at least, to judge from the series of rough rubble pavements thrown across it, was merely a mudhole (Fig. 29).

POTTERY AND OTHER OBJECTS

The following descriptions and illustrations do not by any means represent a complete catalogue of the pottery found in the various loci connected with the water system. An attempt has been made to give a fair selection of all forms, but to stress particularly the types most significant for dating. The pottery from practically all loci was extremely fragmental, and drawings or photographs of many of the actual sherds would be meaningless. Therefore

in some cases the forms have been reconstructed. The descriptions indicate whether the specimen is a fragment, complete (i.e., broken but all parts present), or intact. Taken individually the sherds found in the fillings were of little value, but considering them in aggregate we were able to delimit the dates of the several loci with a fair degree of certainty. Each individual specimen illustrated represents numerous sherds of either identical forms or forms of definitely similar date.

Fig. 30.—Coin M 2656 from the Shaft (925). Actual Size

All other objects of any value found in the various loci connected with the water system are illustrated, except the coins. Of these latter only M 2656, a type apparently hitherto unpublished, is shown (Fig. 30). Twelve coins were found in the shaft, at depths of 2–4 meters. Eleven of them, ranging in date from A.D. 58 to 361, are described below, two (M 2268–69) by Mr. Edward T. Newell, of New York, and the others by Mr. Charles Lambert, of the Department of Antiquities of Palestine. The material is bronze except in the case of M 2476, which is billon. The twelfth coin was too much worn to be identified.

POTTERY AND OTHER OBJECTS

CATALOGUE OF THE COINS

Registration No.	Depth in Meters	Date A.D.	Description	Notes
M 2489	4	58–59	Coin of the procurators. Obverse: [L]ЄKAI . . ;[1] palm branch. Reverse: wreath containing inscription (effaced). 16 mm.	Cf. British Museum, *Catalogue of the Greek Coins of Palestine* by G. F. Hill (London, 1914) p. 266.
M 2467	2	218–22	Coin of Julia Maesa? Neapolis mint. Obverse: bust to r. (details worn; illegible). Reverse: ΦA . . . OΛЄωC; in field r., A; Elpis, wearing mantle and long chiton, the skirt of which she raises in l., moving to l., holding uncertain object in r. 19 mm.	Cf. *ibid.* p. 62, No. 110.
M 2475	3	218–22	Coin of Elagabalus. Tyre mint. Obverse: IMPCAE-SMAVANT ONINVSAVG; laureate bust to r., wearing paludamentum and cuirass. Reverse: within temple, Astarte holding scepter in l.; on l., a trophy on which she places r.; on r., Nike standing on a column extending a wreath to crown Astarte. In the exergue (from l. to r.): palm tree, altar, murex shell; T VRI ORV M. 28 mm.	Cf. British Museum, *Catalogue of the Greek Coins of Phoenicia* by G. F. Hill (London, 1910) p. 276, No. 404.
M 2476	3	248–51	Coin of Herennia Etruscilla. Antioch mint. Obverse: ЄPЄNNIAЄTPOVCKIAAAC ЄB; bust with crescent to r. Reverse: ΔHMAPXЄ[ΞOV]CIAC; eagle on palm branch with wreath in beak. In the exergue: S C. 26 mm. Billon.	Cf. British Museum, *Catalogue of the Greek Coins of Galatia, Cappadocia, and Syria* by Warwick Wroth (London, 1899) p. 223, Nos. 604 ff.
M 2656	2	251	Coin of Herennius Etruscus. Aelia Capitolina mint. Obverse: [CMQDE] . . . AVG; radiate bust to r., wearing paludamentum and cuirass. Reverse: COLAEL . . around; below, boar walking r. on single exergual line representing an ear of corn laid horizontally; center, eagle to r. on branch, with a twig in beak; above, vexillum bearing [L] X F (Decima Fretensis). 25 mm. See Fig. 30.	An apparently hitherto unpublished coin of Aelia. Cf. eagle and vexillum without boar in British Museum, *Catalogue of the Greek Coins of Palestine*, Pl. XL 12.
M 2478	3	3d century	Caesarea mint? Obverse: bust (of an empress?) to r. (details and inscription obliterated). Reverse: inscription illegible; city goddess wearing short chiton and mantle, standing l. holding human bust in r., resting l. on spear; r. foot on prow. 12 mm.	
M 2268 . . .	2	306–37	Coin of Constantine the Great. Antioch mint. Obverse: CONSTANTINVS MAX AVG; diademed and draped bust to r. Reverse: GLORIA EXERCITVS; standard erect between two soldiers. In the exergue: SMANA. Eleventh issue, September, 335—September, 337. 16 mm. Oriental Institute Museum No. A 12196.	Cf. Henry Cohen, *Description historique des monnaies frappées sous l'empire romain* VII (2d ed.; Paris, 1888) 257, No. 250; Jules Maurice, *Numismatique constantinienne* III (Paris, 1912) 212 ii 1°.
M 2269	2	337–61	Coin of Constantius II. Antioch mint. Obverse: DNCONSTAN TIVSPFAVG; diademed and draped bust to r. Reverse: FELTEMP REPARATIO; armed soldier (the emperor?) to l., spearing an enemy on a fallen horse. In the exergue: SMANBI. 18½ mm. Oriental Institute Museum No. A 12209.	Cf. Cohen, *op. cit.* p. 447, No. 45.
M 2488	4	337–61	Coin of Constantius II. Cyzicus mint. Obverse: same as M 2269. Reverse: [FEL]TEMP [RE]-PARATIO; same as M 2269. In the exergue: SMKΓ. 19 mm.	
M 2399	2	337–61	Coin of Constantius II or Constans I. Antioch mint. Obverse: . . . AVG; same as M 2269. Reverse: FELTE . . ; same as M 2269. In the exergue: AN . . . 17 mm.	
M 2487	4	4th century	Coin of Constantius II? Constantinople mint. Obverse: DNCONSTAN TI[V] . . VG; same as M 2269. Reverse: . . . [ARATIO]; same as M 2269. In the exergue: CONSЄ*. 25 mm.	

[1] Dots as used in this catalogue represent merely losses of uncertain or undefined length.

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PLATE I

	Registration No.	Description	Date
		GUARD'S POST	
1	P 3809	Jar fragment, brown ocher ware, many light grits, light red decoration	EI I* (12th century B.C.)
2	P 3773	Jar fragment, similar to No. 1	EI I
3	P 3776	Jar fragment, brown ocher ware, few large white grits	EI I
4	P 3772	Jar fragment, similar to No. 3	EI I
5	P 3817	Flask fragment, brown ocher ware, blue-black core, few large white grits, light red decoration	EI I
6	P 3792 P 3789	Rim of jug, brown ocher ware Base of jug, brown ocher ware, traces of vertical burnishing	MB II
7	P 3791	Jug fragment, brown ocher ware, blue-black core	MB II
8	P 3800	Handle on jug fragment, yellow ware, small black grits	MB II
9	P 3785	Bowl fragment, brown ocher ware, well made	MB II
10	P 3786	Bowl fragment, similar to No. 9	MB II
11	P 3787	Bowl fragment, similar to No. 9	MB II
12	P 3790	Chalice fragment, similar to No. 9	MB II
13	P 3775	Base of hole-mouth jar, handmade, yellow ware, dark red decoration	EB
		ROOM 1133	
1	P 4071	Cup-and-saucer lamp, intact, burnt umber ware, many large white grits, warped	LB II
2	P 4067	Jug, intact, brown ocher ware, well made, light red decoration	LB II
3	P 4069	Jug fragment, brown ocher ware, many light and dark grits, light red decoration	LB II
4	P 4068	Jug fragment, burnt umber ware	LB II
5	P 4070	Chalice, intact, burnt umber ware, few large white grits, light red decoration	LB II

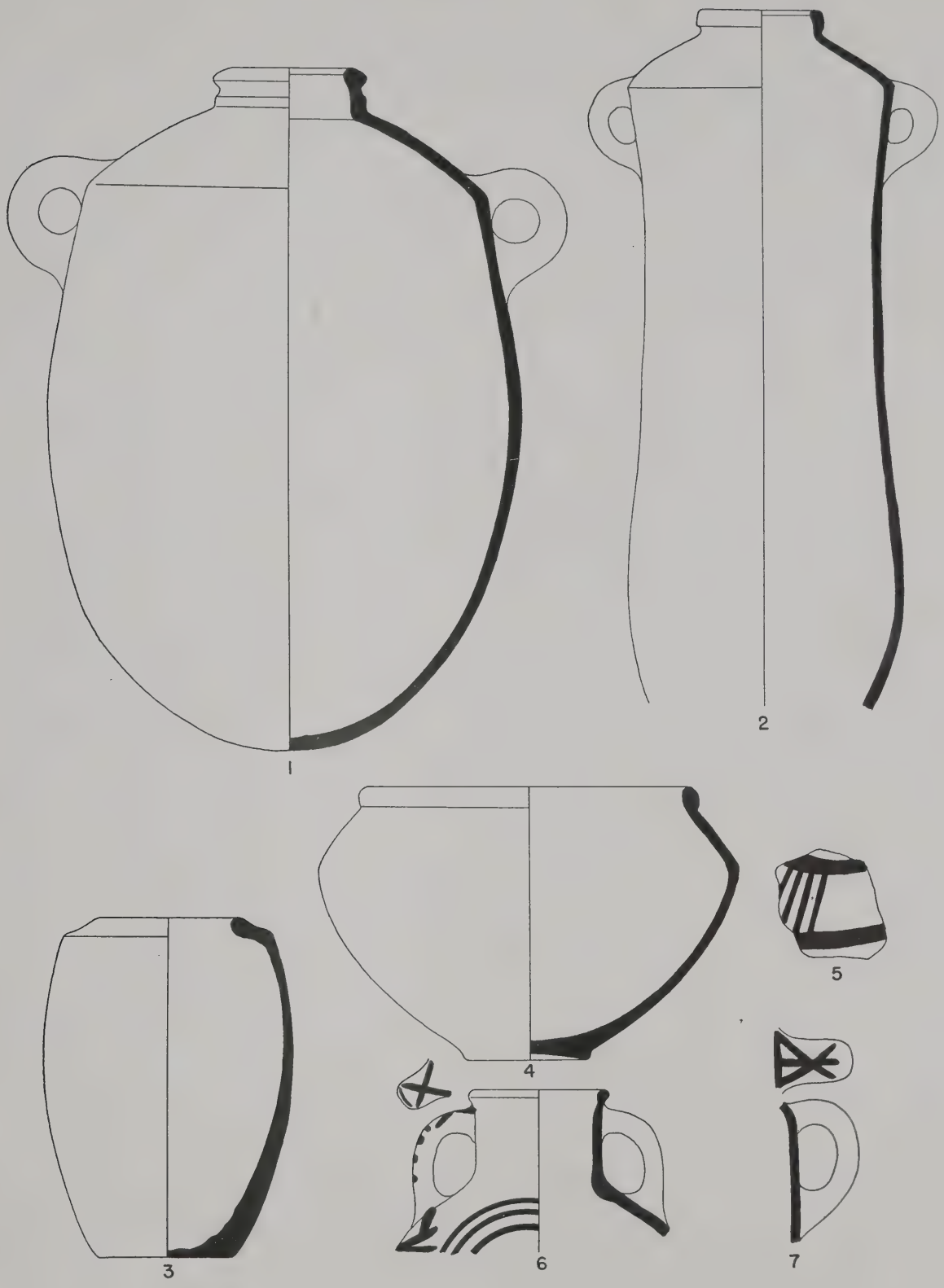
* This and the following abbreviations are now commonly used for the various cultural periods in Palestine. The Bronze (B) and Iron (I) Ages are each subdivided into Early (E), Middle (M), and Late (L); and each of these is in turn divided into two parts (I and II). The overlap comprising LB II and EI I is called B–I.

PLATE I

Pottery from the Filling below the Floor of the Guard's Post (1010) and from Room 1133. Scale, 1:5

PLATE II

	Registration No.	Description	Date
1	P 5959	Jar fragment, blue-black ware, many white grits, heavily fired	MI
2	P 5958	Jar fragment, brown ocher ware, green-yellow slip, well fired	MI
3	P 5960	Jar fragment, green-brown ware, poorly made	MI
4	P 5140	Bowl fragment, brown ocher ware, dark core, light red wash inside	EI I
5	P 5139	Jug fragment, brown ocher ware, few large white grits, light red decoration	EI I
6	P 5137	Flask fragment, yellow to brown ocher ware, well fired, light red decoration	EI I
7	P 5143	Jar fragment, brown ocher ware, blue-black core, many small white grits, light red decoration	EI I

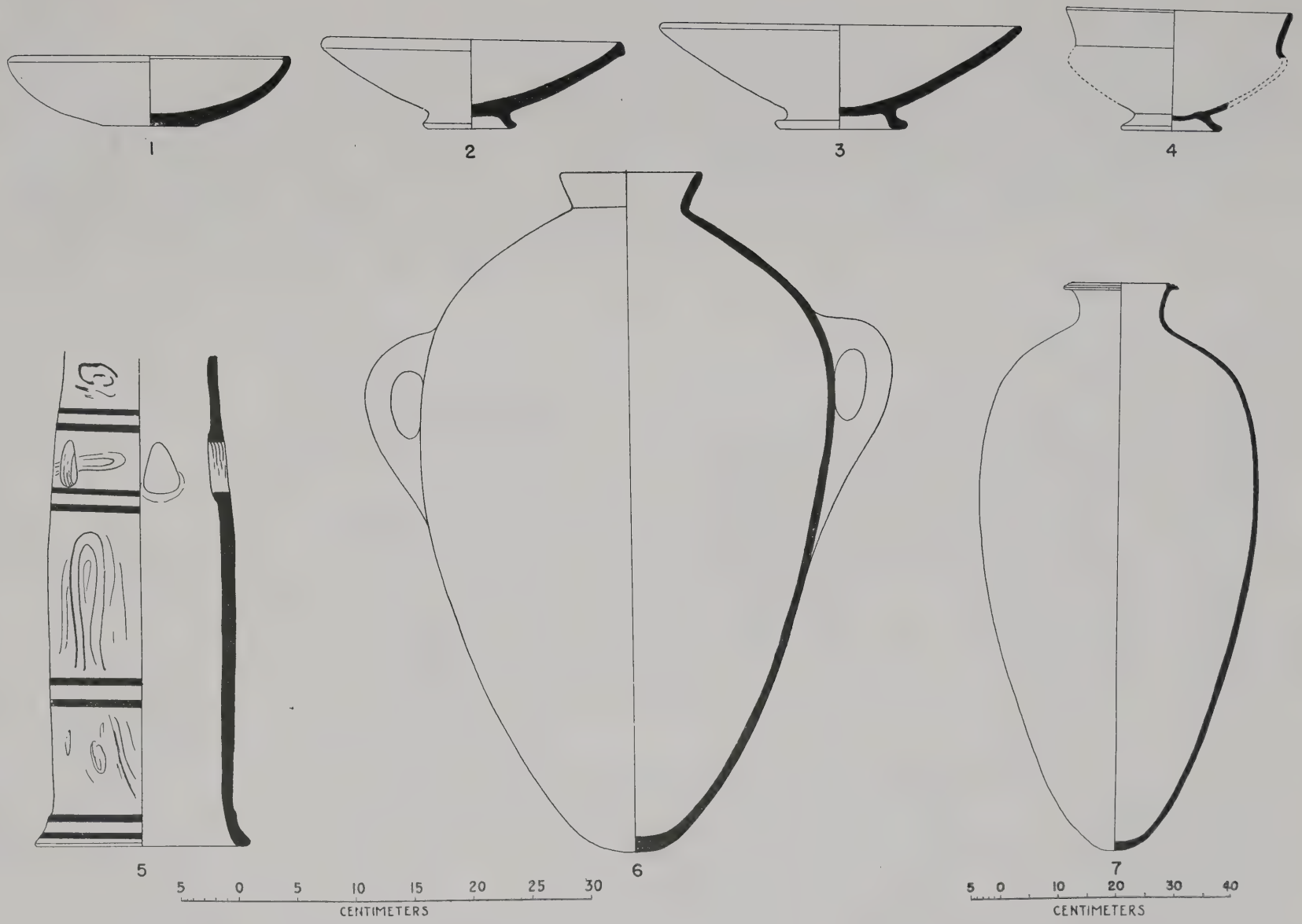


POTTERY FROM THE FILLING IN THE MAIN CAVE. SCALE, 1:5

PLATE III

	Registration No.	Description	Date
1	P 3234	Bowl, complete, burnt umber ware, blue-black core	MB II
2	P 3235	Bowl, complete, burnt umber ware, many small white grits, light red wash inside, badly warped	MB II
3	P 3236	Bowl, complete, brown ocher ware, blue-black core, well made, light red wash over entire vessel	MB II
4	P 3284	Bowl fragment, fine brown ocher ware, well made	MB II
5	P 3237	Incense burner, brown ocher ware, light red and blue-black decoration over white wash, five triangular vents. See also H. G. May, *Material Remains of the Megiddo Cult* ("Oriental Institute Publications" XXVI [Chicago, 1935]; hereafter referred to as *OIP* XXVI) Pl. XIX.	MB II
6	P 3314	Jar fragment, brown ocher ware, dark core, many white grits	MB II
7	P 3316	Jar fragment, burnt umber ware, dark core, burnt umber to brown ocher surface	MB II

PLATE III



POTTERY FROM ROOM 949. SCALE, 1:5 (NO. 7, 1:10)

PLATE IV

	Registration No.	Locus	Description
1	M 3393	1010	Bronze spear-shaft handle. The wood of the shaft extends slightly at both ends.
2	M 3355	1010	Horn object. The upper view shows a hole into which may have fitted a shaft fastened through the holes illustrated in the lower view. The implement may have served as a polisher, since the more pointed end is highly polished and worn. Similar horn objects from Gezer are described as "adze-shaped tools,"* and another from Beth Shemesh is designated as a "stag-horn lock(?)."†
3	M 3362	1010	Pottery loom weight, yellow ware
4	M 3365	1010	Pottery model chariot(?) wheel. See also *OIP* XXVI, Pl. XXI.
5	M 3335	1008	Basalt mortar
6	M 3342	1074	Pumice figurine. See also *OIP* XXVI, Pl. XXXIII.
7	M 3354	1010	Green glazed fayence *wḏꜣt*-eye
8	M 2720	951	Blue glazed fayence whorl
9	M 3377	951	Bone whorl
10	M 2659	951	Blue composition scarab, much fractured on both sides. Two *ꜥnḫ* hieroglyphs may be distinguished on the face.
11	M 3378	951	Carnelian bead
12	M 2726	951	Bronze ring
13	M 3379	951	Bronze bulla
14	M 2721	951	Blue composition bowl

* R. A. S. Macalister, *The Excavation of Gezer* (London, 1912) II 243, note.

† Elihu Grant, *Ain Shems Excavations* I (Haverford, Pa., 1931) Pl. XI 1632.

Objects from Loci 1010, 1008, 1074, and 951. Scale, 1:1

PLATE V

	Registration No.	Description
1	M 2663	Schist ax amulet, broken at both ends
2	M 2662	Bone borer
3	M 2668	Fragment of twisted pottery handle, brown ocher ware. Cf. J. Garrow Duncan, *Corpus of Dated Palestinian Pottery* (London, 1930) 101 L.
4	M 2664	Bronze arrowhead
5	M 2665	Light green glass bead
6	M 2681	Gray glass bead
7	M 2661	Pottery whorl, light brown ware
8	M 2660	Limestone drill socket

PLATE V

Objects from Room 952. Scale, 1:1

PLATE VI

	Registration No.	Description
1	M 2672	Bronze ring
2	M 2651	Bronze dagger blade
3	M 2648	Bronze fibula
4	M 2647	Serpentine whorl
5	M 2650	Limestone drill socket
6	M 2649	Limestone weight. Its present weight, 54.7 grams, differs from original, since it has been secondarily used as a hammer.
7	M 3195	Bronze pin
8	M 2758	Basalt bowl
9	M 2930	Limestone palette with traces of blue inlay
10	M 2771	Pottery loom weight, brown ocher ware
11	M 2931	Pottery loom weight, brown ocher ware
12	M 2932	Pottery loom weight, brown ocher ware

Objects from Room 949. Scale, 1:1 (Nos. 1–7) and 1:2 (Nos. 8–12)

PLATE VII

	Registration No.	Meters below original surface of mound	Description
1	M 2799	5	Tweezers
2	M 2725	12	Handle
3	M 2490	4	Chisel
4	M 2596	2	Tweezers
5	M 2626	8	Ring
6	M 2643	4	Toggle pin
7	M 2513	2	Kohl stick
8	M 2594	4	Ring
9	M 2677	7	Kohl stick
10	M 2628	8	Borer
11	M 2472	3	Disk
12	M 2627	8	Toggle pin
13	M 2634	10	Needle
14	M 2769	17	Weight. It weighs 13.1 grams but is too oxidized to form a good criterion.
15	M 2639	0	Weight. It weighs 2.6 grams but is too oxidized to form a good criterion.
16	M 2765	18	Borer
17	M 2624	9	Blade
18	M 2621	7	Blade
19	M 2620	7	Fibula
20	M 2801	20	Fibula
21	M 2768	17	Fibula
22	M 2789	22	Toggle
23	M 2723	12	Arrowhead
24	M 2767	18	Pin
25	M 2802	20	Iron blade
26	M 2764	18	Drill socket

Metal Objects from the Shaft (925). Scale 1:1. All Are Bronze except No. 25, Which Is Iron

PLATE VIII

	Registration No.	Meters below original surface of mound	Description
1	M 2474	2	Fayence scarab with traces of green glaze, face inscribed with *nfr* hieroglyph and indeterminate figure within encircling rope design
2	M 2800	21	Blue composition scarab with illegible fragmentary inscription
3	M 2710	15	Fayence scaraboid with glaze worn away. Its impression discloses a horned animal before a tree.
4	M 2655	2	Limestone scaraboid. The design on its face may represent two scorpions.
5	M 2796	19	Green glazed fayence scaraboid. The back is in the form of a crouching lion, and the face shows a lion passant before a tree.
6	M 2682	13	Olivine cylinder seal. The impression would appear to represent the cosmological myth of the struggle between Bel (Marduk) and the dragon, especially in the form in which it is found in the apocryphal portion of the Book of Daniel (Bel and the Dragon, verse 27): "Then Daniel took pitch and fat and hair and boiled them together; and he made lumps and put them into the dragon's mouth, and the dragon ate thereof and burst asunder." The object which the bearded god is forcing upon the dragon cannot be a bow, in view of its form and the manner in which it is held; it is probably the bolus of fat, pitch, and hair. The second dragon may be one of the creatures called upon to assist in the fight against the god; or it may represent the vanquishing of the dragon, since the foot of the god is upon its back. The dragons are winged, with birdlike heads and lion bodies. In the field are seven Igigi dots, a branch, a tree or standard, the star of Ishtar, and a rhomb. Cf. William Hayes Ward, *The Seal Cylinders of Western Asia* (Washington, D.C., 1910) pp. 193 ff. and Figs. 574 and 578; Hugo Gressmann, *Altorientalische Bilder zum Alten Testament* (Berlin und Leipzig) p. 108 and Pl. CLI 374; Otto Weber, *Altorientalische Siegelbilder* ("Der Alte Orient" XVII–XVIII) I (1920) Nos. 290–91, 295, 302, 307, and 311.—H. G. May.
7	M 2593	4	Serpentine pendant
8	M 2640	4	Blue composition bead
9	M 2480	3	Felsite bead
10	M 2481	6	Agate bead. It is probably unfinished, since it is unpierced.
11	M 2637	0	Carnelian bead
12	M 2633	10	Carnelian bead
13	M 2485	2	Carnelian bead
14	M 2623	9	Unglazed fayence bead
15	M 2793	19	Carnelian bead
16	M 2797	5	Blue glazed fayence bead
17	M 2794	19	Blue composition bead
18	M 2666	10	Green, black, and yellow glass bead
19	M 2641	4	Blue glazed fayence bead
20	M 2686	14	Gray glass bead
21	M 2473	2	Steatite whorl
22	M 2636	0	Steatite whorl
23	M 2466	6	Steatite whorl
24	M 2722	12	Serpentine whorl
25	M 2632	10	Bone whorl
26	M 2798	5	Steatite whorl
27	M 2469	0	Onyx inlay(?)
28	M 2766	0	Bone socketed pinhead(?)
29	M 2654	2	Agate object
30	M 2724	12	Green and sepia glazed fayence vessel
31	P 3032	13	Pottery jug handle, fine brown ocher ware, ivory black slip, polished surface
32	M 2630	9	Sandstone weight. It is intact, weighing 15.8 grams, and may be considered a fair criterion.
33	M 2679	7	Egyptian alabaster jar
34	M 2658	2	Glass vessel
35	M 2470	0	Glass vessel
36	M 2644	4	Green glazed fayence figurine fragment, belonging to a seated figure with one hand on the inside of the thigh and an edge of the armored(?) dress showing on the outside (or vice versa).
37	M 2638	0	Pottery figurine, light red ware. See also *OIP* XXVI, Pl. XXXVII.
38	M 2717	0	Pottery figurine, plaque type. See also *OIP* XXVI, Pl. XXIX. Probably LB.
39	M 2642	4	Pottery figurine. See also *OIP* XXVI, Pl. XXXI.
40	M 2690	.....	Limestone figurine found near wall 946. See also *OIP* XXVI, Pl. XXXIII.

Miscellaneous Objects from the Shaft (925). Scale, 1:1 (Nos. 1–29) and 1:2 (Nos. 30–40)

Date Due

FACULTY			
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